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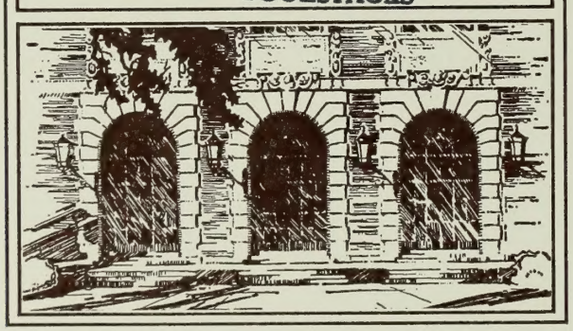

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 7
APRIL 1, 1971

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W71-03301 -- W71-03850

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 7
APRIL 1, 1971

W71-03301 -- W71-03850

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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07 RESOURCES DATA
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09 MANPOWER, GRANTS, AND FACILITIES
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

VACUUM UV ABSORPTION SPECTRA OF LIQUID WATER AND ICE,
For primary bibliographic entry see Field 02K.
W71-03431

1B. Aqueous Solutions and Suspensions

SOLUBILITY AND DISSOLUTION RATE OF AMORPHOUS SILICA IN DISTILLED AND SEA WATER AT 20 DEG C,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 02K.
W71-03436

02. WATER CYCLE

2A. General

PRESENT HYDROLOGIC RESEARCH IN WYOMING AND FUTURE NEEDS.
Wyoming Univ., Laramie. Water Resources Research Inst.

Available from NTIS as PB-196 661, $3.00 in paper copy, $0.95 in microfiche. Wyoming Water Resources Research Institute, Miscellaneous publication (1970). Proceedings of Hydrology Seminary at University of Wyoming, June 25-26, 1970. OWRR Program A-999-WYO (10).

Descriptors: *Planning, *Hydrology, Research, *Wyoming, Runoff, Streamflow, *Surface waters, Watersheds (Basins), Forestry, Land Management, Water quality, Soil conservation, Sagebrush, Snowmelt, *Snow management, Snowpacks, Agricultural engineering, Economics.
Identifiers: Bighorn National Forest, Medicine Bow National Forest.

Contents: Wyoming Water Resources Research Institute, by Louis E. Allen; The Hydrology of Sagebrush Lands and the Management of Blowing Snow, by Ronald D. Tabler; Soil Conservation Service Hydrology and Research Needs in Wyoming, by Lynn A. Brown; Hydrologic Activities of the Agricultural Engineering Division, by Robert D. Burman; Hydrology in the Wyoming Water Planning Program, by Doyl M. Fritz, Peter J. Hutchison and Frank J. Trelease; Water Quality, by Robert L. Champlin; Present Hydrology Programs on the Bighorn National Forest, by Robert E. Lynn; A Manual For Forecasting Snowmelt Runoff, by George W. Peak; Snow Crystal Type as a Function of Vapor Density Excess, by Don Rottner; Present Hydrologic Research and Future Needs in Wyoming, by Jesse L. Honnold; Hydrology and the Wyoming Department of Economic Planning and Development, by Theodore J. Vore; Encampment Barometer Watershed Program - Medicine Bow National Forest, by R. L. Beschta; and Hydrologist and Hydrology - Interpretive Assistance to the District Forest Ranger, by R. S. Aygarn.
W71-03306

GEOMORPHOLOGY AT THE CENTRAL ARID ZONE RESEARCH INSTITUTE, INDIA,
International Inst. for Aerial Survey and Earth Sciences, Delft (Netherlands).
For primary bibliographic entry see Field 07A.
W71-03339

MATHEMATICAL SIMULATION OF HYDROLOGIC EVENTS OF UNGAGED WATERSHEDS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
L. F. Huggins, and E. J. Monke.

Available from NTIS as PB-196 874, $3.00 in paper copy, $0.95 in microfiche. Purdue University Water Resources Research Center Technical Report No 14, Lafayette, Indiana, Dept. of Agricultural Engineering., March 1970. 46 p, 9 fig, 20 ref, append. OWRR Program B-003-IND (8).

Descriptors: *Model studies, *Hydrologic models, *Simulation, Mathematical models, *Watershed, Surface runoff, Overland flow, Depression storage, Interception, Infiltration, Runoff hydrographs.
Identifiers: Hydrologic components.

General modeling concepts and the computational capabilities of a large digital computer was utilized to describe the detailed physical processes occurring within the boundaries of a watershed which in turn could then more precisely characterize the behavior of an entire watershed. It was assumed that a watershed was composed of a composite group of essentially independent elements and that the runoff water from one element was the source of inflow to its adjacent elements. Runoff hydrographs for each elemental area were developed and integrated over the entire watershed. Physical process considered in the model included interception, infiltration, depressional storage and surface flow. A FORTRAN IV program of the mathematical watershed model is included in the report. The model as given is not considered to be in the finished form, but a refinement of the equations governing the component hydrologic relationships is still needed. This applied particularly to the infiltration and surface runoff processes. A primary conclusion was that the strength of the conceptual watershed model as developed was the ease with which it could be modified and improved as individual research advances were made in the areas associated with the various hydrologic components delineated in the model. (Wiersma-Purdue)
W71-03520

DEFINITION AND USES OF THE LINEAR REGRESSION MODEL,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
M. H. Diskin.
Water Resources Research, Vol 6, No 6, p 1668-1673, December 1970. 6 p, 4 fig, 2 tab, 11 ref.

Descriptors: *Regression analysis, *Rainfall-runoff relationships, *Statistical models, Precipitation (Atmospheric), Streamflow forecasting, Runoff forecasting, Water storage, Seasonal.
Identifiers: *Rainfall-runoff models.

A simple three-element model is proposed as an interpretation of the regression equation for the relationship between annual rainfall and annual runoff from watersheds. The model employs two parameters that are related to the constants used in the regression equation. The parameters of the model can be evaluated by the usual least squares equations if the runoff data do not include zero or near zero values. For arid or semiarid watersheds where runoff may be zero for some years, a special procedure is proposed for evaluating the parameters. The procedure seeks the minimum of an objective function defined as the sum of squared deviations between observed data and prediction lines defined by the regression model. (Knapp-USGS)
W71-03682

FLOOD SERIES COMPARED TO RAINFALL EXTREMES,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 02E.
W71-03685

POSSIBLE EFFECTS OF PRECIPITATION MODIFICATION ON STREAM CHANNEL GEOMETRY AND SEDIMENT YIELD,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 03B.
W71-03693

SOME GENERAL COMMENTS ON THE SYNERGISTIC RUNOFF EFFECT FROM JOINT WATERSHED MANAGEMENT AND WEATHER MODIFICATION,
State Univ. of New York, Syracuse. Water Resources Center.
Richard H. Hawkins.
Journal of Hydrology, Vol 11, No 4, p 412-420, November 1970. 9 p, 2 fig, 9 ref.

Descriptors: *Weather modification, *Water yield improvement, *Watershed management, *Mathematical models, Water yield, Artificial precipitation, Cloud seeding, Rainfall-runoff relationships, Evapotranspiration control.
Identifiers: *Synergistic effects, *Watershed management effects.

The synergistic effect in combined watershed and weather modification efforts is discussed and explored in general terms. Using an annual precipitation-runoff model, it is demonstrated that synergism is an expected phenomenon in models under most conditions and assumptions. An expression for locating the precipitation corresponding to the maximum synergism is presented. Two separate functional models are used to illustrate the use of the general relationships derived, and specific data are used to provide perspective and scale. Expressions for the weather modification efficiencies are presented and discussed. The volumes of the synergistic increases, as drawn from a real example, are quite modest, (about 0.05 inches), and might be undetectable in a real situation. (Knapp-USGS)
W71-03696

THE GENETIC METHOD OF COMPUTATION OF FLOOD CAUSED BY STORM RAINFALLS IN SMALL CATCHMENT AREAS IN THE ABSENCE OF HYDROLOGICAL DATA,
Wyzsza Szkola Rolnicza, Wroclaw (Poland).
J. Woloszyn.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), P 301-312, 1969. 12 p, 6 fig, 1 tab, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Depth area-duration analysis, *Water balance, Statistical methods, Routing, Duration curves, Frequency analysis, Rainfall intensity, Rainfall disposition, Small watersheds, Flood forecasting, Runoff forecasting.
Identifiers: Rainfall floods.

A number of well known regional and universal formulas for runoff from storm rainfall are reviewed with emphasis on the formulas which are drawn from the analysis of the genetic formation of runoff. In these the rate of flow depends on intensity and duration of rainfall as well as on basin characteristics and on wave velocity in the stream profile. However, for computation of runoff of a definite probability of occurrence, the rainfall intensity should be determined following the same principles that are applied for the actual series, that is following the distribution of Pearson's type III curve. The distribution of empirical formulas on a group basis is discussed. The probability method for computation of the rainfall intensity, adaptation of this for computing the flow of high water from small basins, and transposing it to uninvestigated areas by means of the monthly mean precipitation and air temperature are illustrated by diagrams and examples. (Knapp-USGS)
W71-03716

METHOD OF COMPUTING RAINFALL FLOODS CHARACTERISTICS,
Kazakhskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Alma-Ata (USSR).
U. B. Vinogradov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 312-320, 1969. 9 p, 1 tab, 1 ref.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, Water balance, Hydrograph analysis, Stochastic processes, Probability, Routing, Infiltration, Hydrologic budget, Frequency analysis.
Identifiers: Rainfall floods.

The main relationships of infiltration processes, surface and rapid subsurface runoffs, and flood formation are examined. The basic formulas to compute infiltration, runoff, hydrographs of inflow to the channel network and runoff at the outlet are given. The fundamental theory of random functions is applied to analyze the process of precipitation and to compute surface runoff. The statistics of distribution curves of daily totals of precipitation and duration of rainfall are discussed with special attention paid to the composition method of determining the probability characteristics of rainfall floods. The possibility of mapping the parameters of distribution curves of precipitation and of systematizing the physical parameters of drainage basins is illustrated by an example from Central Asia and the South Kazakhstan mountain area. (Knapp-USGS)
W71-03717

CONTRIBUTION TO THE METHODOLOGY OF EVALUATION OF MAXIMUM FLOOD FLOW WHEN AVAILABLE DATA ARE INSUFFICIENT (FRENCH),
Office de la Recherche Scientifique et Technique Outre--Mer, Paris (France).
J. Rodier.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 283-289, 1969. 7 p, 3 ref.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, Hydrographs, Duration curves, Routing, Stream gages, Hydrologic data, Design flood, Peak discharge.
Identifiers: Isochrone method.

Methods used in the Hydrological Service of the ORSTOM for rainfall floods in Africa, on islands of the Indian Ocean and in the Pacific, are presented. The management and the study of numerous representative basins led to general methods for determining the elements of the rainfall-runoff relations and for estimating floods on small basins without observational data. It is possible to transfer these methods to other regions provided that some adjustments are made to the rainfall and flood regimes. The relations between the decennial or centennial floods and median floods for large basins in Central Africa are determined. With adjustments for natural conditions they are applied to basins with few records. For medium basins the method of isochrones is used, especially for maximum possible floods and for the case of a cyclonic regime. In this case the envelop curves are used as well. (Knapp-USGS)
W71-03718

EXPERIMENTAL STUDY OF RAINFALL RUNOFF,
Gidrometeorologicheskii Institut, Odessa (USSR).
A. N. Befani, N. F. Befani, E. D. Goptchenko, A. G. Ivanenko, and T. V. Odrova.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 274-282, 1969. 9 p, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Hydraulic models, *Computer models, Demonstration watersheds, Simulated rainfall, Infiltration, Runoff, Groundwater movement, Water balance, Hydrologic budget, Routing, Mathematical studies, Drainage, Seepage.
Identifiers: Runoff models.

Results of long-term experimental research on rainfall-runoff on plain and mountain watersheds situated in different regions of the USSR are discussed. Methods of active experimentation include sprinkling of plots and natural small drainage basins, slope submersion, and pit digging. The results obtained are outlined. Data generalization methods are explained. Experimental formulas determining surface absorption, infiltration into an underlying confining layer on mountain slopes, soil retention of a friable rock layer in mountainous regions, accumulation, residual (contact and general) water storage on slopes, time of travel of surface and contact (drainage and confined) waters and contact and surface components of flood runoff are given. Special attention was paid to data generalization techniques using electronic omputers. A comparison of results obtained by using experimental formulas and data of experimental stations is given. Fair agreement between computations and flood data prove the suitability of the experimental method and its useful role in flood studies. (Knapp-USGS)
W71-03719

RAINFALL FLOOD FORMATION THEORY AND METHODS OF RAINFALL FLOOD COMPUTATION,
Gidrometeorologicheskii Institut, Odessa (USSR).
A. N. Befani.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 259-273, 1969. 15 p, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, Stage-discharge relations, Floods, Flood plains, Runoff, Runoff forecasting, Design flood, Hydraulics, Routing.
Identifiers: USSR, Rainfall floods.

Fundamentals of the theories used in the USSR of different rainfall runoff types include: suspended surface runoff, comprising the predominant part of the surface inflow of rivers of the plains and a certain part of mountain river runoff; backwater surface runoff from mountain slopes arising as a result of saturation of friable ground;backwater runoff from flooded lowlands; and contact runoff from mountain slopes in friable sediment strata overlying a relatively confining layer (drainage, vein, stratum and fissure runoff). Formulas for runoff depth computation and hydrograph equations are proposed for each type of runoff. For mixed (rainfall and snowmelt) floods theoretical formulas of contact and surface components are elaborated. The problem of derivation on a theoretical basis of design formulas is set and solved as a tak of a regional nature, because the nature and genesis of floods vary from one region to another; hence the combinations of factors vary as well. Methods of calculation of regional runoff relationships including formulas of accumulation and reduction of precipitation, typical equations of rainfall graphs, isochron curves, retention, absorption and infiltration formulas, etc. are discussed. Primary attention is paid to the slope water formation (difference of precipitation and simultaneous losses) design problem. Two designs are based on: (1) Obtaining series of water formation on various arable lands using infiltration formulas (synthetic method) and (2) Mapping of the water formation conditional coefficient (the ratio of water formation and precipitation depth of the same frequency). (Knapp-USGS)
W71-03720

THE EFFECT OF RAINFALL ON THE MECHANICS OF STEADY SPATIALLY VARIED SHEET FLOW ON A HYDRAULICALLY SMOOTH BOUNDARY,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03727

2B. Precipitation

THE EFFECT OF RAINDROP IMPACT AND SURFACE ROUGHNESS ON SHEET FLOW,
Illinois Univ., Urbana. Water Resources Center.
Harry G. Wenzel.
Favailable from NTIS as PB-196 664, $3.00 in paper copy, $0.95 in microfiche. Final Report, Illinois Water Resources Center, Urbana, WRC Research Report No 34, September 1970. 115 p, 34 fig, 23 ref, append. OWRR Project B-018-ILL (3).

Descriptors: *Impact (Rainfall), Numerical analysis, *Raindrops, Resistance, Roughness (Hydraulic), *Shear stress, *Sheet flow, Soil erosion, Transition flow, *Turbulence, Flow, Rainfall, Reynolds number, Sheet erosion.

An experimental and analytical study was conducted to investigate the mechanics of sheet flow as it is affected by rainfall. Water surface profile data were taken in a laboratory flume using artifically generated rainfall and a hydraulically smooth surface. The one-dimensional spatially varied flow equation as developed from the momentum approach was then used to compute the boundary shear stress and subsequently a Weisbach type friction factor. It was found that the results below a Reynolds number of approximately 1000 could be expressed as f — C/NR where C increases with increasing rainfall intensity and suface slope. Velocity profile studies show that velocity in the surface region is retarded by the rainfall. Turbulence intensity measurements indicate that turbulence is generated at the surface due to the rainfall and also at the boundary for flow which would normally be laminar without rainfall. Special analysis of the turbulent measurements indicates that the rainfall shifts the turbulent energy to higher frequencies than would be the case without rainfall. Analysis of the flow over rough surfaces taken by the Corps of Engineers shows that rainfall has little effect on resistance beyond the transition region and the transition point may be lowered by the presence of rainfall. A separate study of a single drop striking a stagnant water layer shows that the velocity and pressure field can be computed using a Synthetic Cell-Fluid scheme to solve the Navier-Stokes equations for this case. A dimensionless maximum impact pressure model was developed and the velocity field and freee surface configuration were studied. It was found that surface tension is significant, the diameter of the region of disturbance was approximately one inch, and that locally high shear stress are generated. These stresses could easily cause soil erosion.
W71-03310

TEMPORAL VARIATIONS IN THE NATURE OF ATMOSPHERIC DUST ABOVE AN INTERIOR DESERT BASIN,
Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
Glenn B. Hoidale, and Abel J. Blanco.
Archiv Fur Meteorologie, Geophysic und Bioklimatologie, Series A, Vol 19, No 1, p 71-88, 1970. 7 fig, 3 tab, 8 ref.

Descriptors: *Advection, *Dusts, *Spectroscopy, *Atmospheric physics, *Topography, Particle size, Precipitation (Atmospheric), Convection, Infrared radiation, Aerosols, New Mexico, Deserts, Arid lands, Great Plains, Silicates, Clays, Carbonates, Absorption, Topography, Meteorology, Aeolian soils, Spectrophotometry, Winds, Air circulation, Cloud physics, Diurnal distribution, Southwest U.S., Variability, Fronts (Atmospheric).
Identifiers: *Infrared absorption, *Exchange layers.

The infrared absorptive properties of giant and large atmospheric dust particles have been little studied. The arid southwestern U.S. has a abundance of loose, unconsolidated soil particles exposed to eolian translocation and various meteorological factors which effect a transport of this mineral-laden dust in high-atmospheric concentrations to other geographical areas which in turn may affect the composition and transmission properties of the atmospheric dusts of those areas. Dust from the tropospheric aerosol was sampled on a 1250 m. peak overlooking the arid Tularosa Basin. The infrared absorption spectrum was dete

mined and interspectral variations were quantified by the relative intensities of silicate clay and carbonate absorption bands (A/B ratio). A systematic temporal variation of the A/B ratio occurred. The ratio was high during early morning periods of convective activity, precipitation and cold frontal passages from the east and low in the afternoon at in times of low convection or precipitation. Apparently, advection of fresh particles from adjacent regions exchange layer caused the low ratio and the high ratio was caused by advected fresh continental particles from the western Great Plains and aged particles from the free atmosphere. (Casey-Arizona)
W71-03332

METEOROLOGICAL DATA AND THE AGRICULTURAL PROBLEM,
Connecticut Agricultural Experiment Station, New Haven.
P. E. Waggoner.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 25-38, UNESCO, 1968. 2 fig, 3 tab, 50 ref.

Descriptors: *Evapotranspiration, *Precipitation (Atmospheric), *Climatology, *Solar radiation, *Decision making, Arid lands, Droughts, Agriculture, Temperature, Wind velocity, Evaporation, Economic justification, Planning, Vapor pressure, Probability, Probable maximum precipitation, Project planning, Cost-benefit analysis, Forecasting, Statistical methods, Meteorological data.
Identifiers: *Agriclimatology, *Decision matrices, *Gumbel distribution.

The major importance of agricultural climatology lies in providing information for long-term investment strategies. Operationally, this involves construction of a decision matrix in which planning alternatives and profit data suitable to a given situation entered with meteorological data. If profit expectations between alternatives are different, then action is justified. Useful meteorological data will permit profitability predictions in new projects and will be less useful to traditional agriculture. A suitable weather parameter must therefore be determined, together with useful probabilities, for inclusion in the decision matrix. Drought is the crucial factor in crop growing and is a function of both precipitation and evaporation. Evaporation is focussed upon as the more crucial factor and the Penman method of daily evapotranspiration calculation is described. It is shown that with this criterion, radiation data is most important and humidity and wind speed less important. For a decision matrix, probabilities rather than means are the important climatological figures. When drought indices, precipitation and temperature data were reviewed, it was found that a suprisingly small amount of data from a single station allows an estimate of probabilities. (Casey-Arizona)
W71-03343

DERIVED METEOROLOGICAL DATA: TRANSPIRATION,
Institut for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02D.
W71-03345

WEATHER AND PLANT DISEASE FORECASTING,
Weather Bureau, Tifton, Ga. Agricultural Service Office.
For primary bibliographic entry see Field 03F.
W71-03348

HURRICANE CAMILLE ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 07C.
W71-03381

THE EFFECT OF WIND ON THE PRECIPITATION DISTRIBUTION OVER A HILLOCK,
John Sandsborg.
Nordic Hydrology, Vol 1, No 4, p 235-244, 1970. 10 p, 6 fig, 2 tab, 6 ref.

Descriptors: *Rain gages, *Rainfall disposition, *Distribution patterns, Meteorology, Equipment, Networks, Calibrations, Precipitation gages, Gaging stations.
Identifiers: Sweden.

Precipitation measurements were made on a hillock during June-November 1959 by means of a very dense network of gages. The precipitation distribution of single rainfall could vary considerably owing to wind conditions. The cause of this phenomenon seems to lie in the aerodynamic conditions around the hillock. When choosing sites for precipitation measurements such aerodynamic effects should be known. The leeward side receives less precipitation than the windward side. This is especially the case for rainfalls in high wind, when the crest of the hillock also has markedly lower precipitation values than the precipitation mean. (Knapp-USGS)
W71-03395

ON ICE NUCLEATING PROPERTIES OF DIFFERENT FACES OF SILVER IODIDE CRYSTALS,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 03B.
W71-03430

SOLID PRECIPITATION IN SUPER-COOLED CLOUD: PART 1 - FREEZING OF A SUPERCOOLED WATER DROP DUE TO THE COLLISION OF ICE CRYSTALS,
Nagoya Univ. (Japan). Water Research Lab.
Takao Takeda.
Journal of Meteorological Society of Japan, Series 2, Vol 46, No 1, p 14-28, February 1968. 15 p, 9 fig, 1 tab, 17 ref.

Descriptors: *Precipitation (Atmospheric), *Cloud physics, *Supercooling, *Condensation, Ice, Nucleation, Atmospheric physics, Statistical methods, Velocity, Clouds, Freezing, Winds, Crystal growth.
Identifiers: Supercooled clouds.

The freezing-probability of a supercooled water drop, which grows by the capture of cloud droplets due to the collision of ice crystals formed on ice nuclei, was numerically studied in clouds. In all cases, the probability increases about 100 times when the drop is at cloud top, and most of collisions with ice crystals take place when the drop stays near cloud top. The accumulated number of ice crystals colliding with the drop increases with the vertical velocity of air-currents and the height of cloud top. The accumulated number of colliding ice crystals is larger in clouds of small water content than in clouds of large water content, although it tends to increase with the water content in early stage of the growth of the drop. In clouds with tops lower than 3000 m and with velocity of updraft of only a few meter/sec, at most, one drop in 10 to 100 supercooled water drops can collide with one ice crystal in 1.0 to 1.5 hour. (See also W71-03433) (Knapp-USGS)
W71-03432

SOLID PRECIPITATION IN SUPERCOOLED CLOUD: PART 2 - GROWTH OF A SOLID PRECIPITATION PARTICLE,
Nagoya Univ. (Japan). Water Research Lab.
Takao Takeda.
Journal of Meteorological Society of Japan, Vol 46, No 4, p 255-265, August 28, 1968. 11 p, 6 fig, 1 tab, 16 ref.

Descriptors: *Precipitation (Atmospheric), *Cloud physics, *Supercooling, *Condensation, Ice, Nucleation, Atmospheric physics, Statistical methods, Velocity, Clouds, Freezing, Winds, Crystal growth.
Identifiers: Supercooled clouds.

The growth rates of solid precipitation particles in a supercooled cloud were studied by numerical computations for the case when sublimation and the capture of cloud droplets take place simultaneously. The necessary condition for the predominance of the capture-process in the growth of solid precipitation particles (for the formation of graupel) is that the particle is initially a 'frozen drop' with radius larger than a critical value which is dependent mainly upon the initial height of the particle. The relationship between the computed radii of graupel particles at cloud base and the height of the cloud top is in satisfactory agreement with that obtained from observations. The computed probability that 'frozen drops' of the critical size are formed by nucleation of supercooled water drops in collision with ice crystals is about 10% of that expected from observations. (Knapp-USGS)
W71-03433

THE EFFECTS OF THE TIME LAG IN THE ACTIVATION OF ATMOSPHERIC ICE NUCLEI ON THE NUMBER OF ICE CRYSTALS IN CLOUD,
Nagoya Univ. (Japan). Water Research Lab.
Takao Takeda.
Journal of Meteorological Society of Japan, Series 2, Vol 46, No 2, p 69-75, April 1968. 7 p, 7 fig, 12 ref.

Descriptors: *Precipitation (Atmospheric), *Cloud physics, *Supercooling, *Condensation, Ice, Nucleation, Atmospheric physics, Statistical methods, Velocity, Clouds, Freezing, Winds, Crystal growth.
Identifiers: Supercooled clouds.

The influence of the time lag in the activation of ice nuclei on the number of ice crystals in clouds was numerically studied. The increase in the number of activated atmospheric ice nuclei with cooling-time is remarkable, particularly cooling at lower temperatures than -25 deg C. The total number of atmospheric ice nuclei activated in a few hours under cooling at -30 deg C to -40 deg C is 10 times as large as in 1 minute, while the number of activated at temperatures warmer than-20 deg C is at most 3 times as large. The number of atmospheric ice nuclei activated in upward air-currents with vertical velocities of the order of 10 cm/s is 5 to 10 times as large as in air-currents of the order of 10 m/s. (Knapp-USGS)
W71-03434

AD HOC MEETING ON ACIDITY AND CONCENTRATION OF SULPHATE IN RAIN.
Organization for Economic Co-Operation and development, Paris (France).

Organization for Economic Co-Operation and Development, Ex 40119, 1970. 19 p, 1 fig, 7 tab, 2 append.

Descriptors: *Precipitation (Atmospheric), *Rain, *Sulfates, *Acidity, Metereology, Air pollution, Monitoring, Water pollution sources, Data collections, Carbonates, Electrical conductance, Conferences.
Identifiers: *OECD, *Sulphur dioxide, Sweden, Norway, Finland, Denmark, Iceland, Austria, United Kingdom, Ireland, Germany, Netherlands, Belgium, France.

This 1969 report by the representatives of seven European countries surveys the problem of precipitation, its acidification, and sulphate content. The report is supplemented by a record of pertinent data compiled by Swedish workers in 12 countries of western Europe. Their atmospheric chemistry network detected an overal increase in acidity of precipitation in Scandinavia and central Europe, but not in Great Britain or Ireland. A similar trend was recorded in regard to the concen-

tration of sulphates. As atmospheric sulphur compounds are transported over long distances, remedial measures require international collaboration. (Wilde-Wisconsin)
W71-03444

RADAR MEASUREMENT OF PRECIPITATION RATE,
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
For primary bibliographic entry see Field 07B.
W71-03527

PERSISTENCE OF PRECIPITATION AT 108 CITIES IN THE CONTERMINOUS UNITED STATES,
Weather Bureau, Silver Spring, Md.
Donald L. Jorgensen, and William H. Klein.
Environmental Sciences Service Administration Technical Memorandum WBTM TDL 31, May 1970. 84 p, 6 fig, 3 tab, 14 ref, 2 append.

Descriptors: *Precipitation (Atmospheric), *Weather data, *Meteorological data, Data collections, Probability, Weather forecasting, Statistical methods, Weather patterns.
Identifiers: *Persistence (Precipitation).

Values of persistence of precipitation for each of the four seasons have been derived for 108 cities in the conterminous United States. These values show significant differences between stations and seasons and show general behavior of storm systems and atmospheric circulations responsible for precipitation occurrences. Examples are given illustrating the application of persistence to the forecasting problem. The relationship between persistence and the coefficient of correlation involving successive precipitation events is developed. The data presented should serve as important supplementary information in evaluating continuity trends in precipitation. Persistence determinations are presented in tabular form. The basic data on which these derivations are made consist of 15 years of precipitation records for the period December 1949 through November 1964. Persistence is determined for each of the cities by seasons on the condition that precipitation occurred or did not occur in the conditional (preceding) period for eight verifying periods consisting of four 6-hour, two 12-hour, and two 24-hour periods. (Knapp-USGS)
W71-03673

ESTIMATION OF BASIN PRECIPITATION BY REGRESSION EQUATION,
Meteorological Service of Canada, Toronto (Ontario).
J. A. W. McCulloch, and M. Booth.
Water Resources Research, Vol 6, No 6, p 1753-1758, December 1970. 6 p, 2 tab, 4 ref.

Descriptors: *Precipitation (Atmospheric), *Data collections, *Meteorological data, *Regression analysis, Synoptic analysis, Lake Ontario, Computer programs, Rainfall-runoff relationships.
Identifiers: *Canada.

Regressions on 30 years of precipitation data from five stations for the calculation of the monthly amount of precipitation falling on the land portion of the Lake Ontario basin are presented. Verification on three years of test data shows a maximum cumulative annual error of 4%, with individual monthly errors as high as 17%. Provision for missing data is made. (Knapp-USGS)
W71-03691

REMOTE RECORDING PRECIPITATION GAGE,
For primary bibliographic entry see Field 07B.
W71-03711

2C. Snow, Ice, and Frost

ON ICE NUCLEATING PROPERTIES OF DIFFERENT FACES OF SILVER IODIDE CRYSTALS,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 03B.
W71-03430

VACUUM UV ABSORPTION SPECTRA OF LIQUID WATER AND ICE,
For primary bibliographic entry see Field 02K.
W71-03431

SOLID PRECIPITATION IN SUPER-COOLED CLOUD: PART 1 - FREEZING OF A SUPER-COOLED WATER DROP DUE TO THE COLLISION OF ICE CRYSTALS,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 02B.
W71-03432

SOLID PRECIPITATION IN SUPERCOOLED CLOUD: PART 2 - GROWTH OF A SOLID PRECIPITATION PARTICLE,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 02B.
W71-03433

THE EFFECTS OF THE TIME LAG IN THE ACTIVATION OF ATMOSPHERIC ICE NUCLEI ON THE NUMBER OF ICE CRYSTALS IN CLOUD,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 02B.
W71-03434

GROUNDWATER THERMAL REGIME IN A GLACIAL COMPLEX,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02F.
W71-03464

2D. Evaporation and Transpiration

THE ROLE OF THE MESOPHYLL CELL WALL IN LEAF TRANSPIRATION,
Australian National Univ., Canberra. Research School of Biological Sciences.
For primary bibliographic entry see Field 02I.
W71-03330

METEOROLOGICAL DATA AND THE AGRICULTURAL PROBLEM,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 02B.
W71-03343

DERIVED METEOROLOGICAL DATA: TRANSPIRATION,
Institut for Land and Water Management Research, Wageningen (Netherlands).
P. E. Rijtema.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 55-72, UNESCO, 1968. 16 fig, 46 ref.

Descriptors: *Evapotranspiration, *Interception, *Diffusion, *Energy budget, *Soil-water-plant relationships, Stomata, Lysimeters, Crops, Environmental effects, Mode of action, Meteorological data, Resistance, Precipitation (Atmospheric), Light intensity, Surfaces, Evaporation, Agriculture, Hydrology, Root systems, Leaves, Physiological ecology, Canopy, Soil surfaces, Water loss, Theoretical analysis, Energy transfer, Equations, Permeability, Water vapor, Turbulence, Instrumentation, Measurement, Data collections.
Identifiers: *Agroclimatology, *Potential evapotranspiration, *Bowen ratio, *Leaf tissue suction, *Partial soil cover, Evaporating surface roughness.

Real evapotranspiration is a function of interacting meteorological, plant physiological and soil physical factors. Since the energies available for water vaporization and vapor transport are the crucial meteorological factors determining evapotranspiration rate, it may be calculated using the turbulent vapor transport method or the Bowen ratio method, and approaches utilizing these methods are discussed. In agricultural and hydrological applications they are limited by the complex instrumentation required. Combined aerodynamic and energy balance methods using standard meteorological data are more practical. Precipitation interception increases total evapotranspiration under all conditions in which reduced transpiration is present. Crop diffusion resistance, which depends on number and size of stomata and the soil cover, can be used to calculate crop transpiration. Real transpiration equals crop transpiration plus intercepted precipitation evaporation. Calculations using this relationship are shown to agree closely with measured evapotranspiration values. Direct determinations of evapotranspiration using the Bowen ratio and turbulent vapor transfer methods combined with lysimeter studies, suffer from the lack of data on evaporating surface roughness, partial soil cover, light intensity, leaf tissue suction and interception. (Casey-Arizona)
W71-03345

THE USE OF SOIL WATER BALANCE RELATIONSHIPS IN AGROCLIMATOLOGY,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
R. O. Slatyer.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 73-87, UNESCO, 1968. 9 fig, 4 tab, 60 ref.

Descriptors: *Evapotranspiration, *Measurement, *Water balance, *Soil-water-plant relationships, *Soil water, Arid lands, Lysimeters, Runoff, Precipitation (Atmospheric), Deep percolation, Instrumentation, Estimating equations, Physiological ecology, Climates, Climatology, Environmental effects, On-site data collections, Evaporation, Interception, Stemflow, Xerophytes, Root systems, Leaves, Crops, Rainfall-runoff relationships, Mode studies, Mode of action, Probability, Probable maximum precipitation, Irrigation efficiency, Planning, Soil water movement, Water storage, Storage capacity.
Identifiers: *Agroclimatology, *Potential evapotranspiration, *Soil water balance, *Australia.

Utilization of soil water balance data for agroclimatological purposes presents many problems where there is a lack of meteorological data. The soil water balance equation includes precipitation, runoff, deep drainage, evapotranspiration, and changes in soil water storage. Evapotranspiration is usually deduced from measurements of the other factors. Discussions of each factor in the equation indicate problems involved in measurements, particularly in arid lands. Agroclimatological models using soil water balance data are usually set up on the basis of water budget. Consequently, they require relationships which predict: (1) available soil water storage capacity in the root zone, (2) soil water storage increments resulting from precipitation, (3) drainage below the root zone and (4) surface evapotranspiration. Attempts to predict these phenomena under varying conditions for irrigation planning purposes require simplifying assumptions often likely to lead to error, particularly in arid lands. Factors involving model development for use in the Alice Springs area, Australia, are detailed. Actual potential evapotranspiration patterns for

lifferent sites and methods for testing and utilizing hese models are described. In communities with videly spaced plants, the accuracy of the evapotranspiration model is unsatisfactory. (Casey-Arizona)
W71-03346

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
Army Electronics Command, Fort Huachuca, Ariz. Atmospheric Science Lab.
For primary bibliographic entry see Field 03B.
W71-03473

INHIBITION OF OXYGEN EVOLUTION IN CHLOROPLASTS ISOLATED FROM LEAVES WITH LOW WATER POTENTIALS,
Illinois Univ., Urbana. Dept. of Botany.
J. S. Boyer, and Barbara L. Bowen.
Plant Physiology, Vol 45, p 612-615, 1970. 5 fig, 19 ref. OWRR Project A-028-ILL (1).

Descriptors: *Photosynthesis, *Photosynthetic oxygen, *Leaves, *Inhibition, *Drying, Analytical techniques, Wilting, Carbon dioxide, Plants, Stomata, Centrifugation, Plant tissue, Light intensity, Transpiration control, Measurement, Moisture content, Oxygen, Plant physiology.
Identifiers: *Chloroplasts, *Water potential, *Oxygen evolution, Carbon dioxide evolution, Alaska pea, Sunflower.

Research was undertaken to determine whether O sub 2 evolution by chloroplasts is inhibited when leaves are exposed to moderate desiccation. Chloroplasts were isolated from leaves of Alaska pea and sunflower by a micro Waring blander and centrifugation. Oxygen evolution was measured with a Clark-type electrode in an assay medium illuminated to saturation into which chloroplasts were injected. Controls from non-desiccated leaves were also measured. Co sub 2 fixation by intact plants was measured for comparisons, using an infrared gas analyzer. Transpiration was measured by collecting water condensed in the assimilation chamber. Isolation of chloroplasts had no effect on O sub 2 evolution. O sub 2 evolution by chloroplasts was reduced in tissue moderately desiccated. The degree of desiccation was more important than the duration. The magnitude of inhibition depended on the species: sunflower was more inhibited than pea. Low leaf water potential affects photosynthesis by inhibition of O sub 2 evolution in chloroplasts and by closure of stomata in intact leaves. Inhibition of O sub 2 evolution has not been previously described in moderately desiccated leaves. Increases in cytoplasmic resistance to CO sub 2 diffusion are probably related to chloroplast changes. The article contains 5 graphs which support the conclusions. (Yensen-Arizona)
W71-03484

A STUDY OF EVAPORATION SUPPRESSANTS UNDER GREENHOUSE CONDITIONS: EVALUATIONS I TO IV,
Texas Agricultural Experiment Station, College Station.
C. W. Wendt, and J. R. Runkles.
Texas A and M University, Texas Agricultural Experiment Station, Progress Reports: I, PR-2510, (Feb 1968); II, PR-2542, (May 1968); III, PR-2647, (Feb 1969); IV, PR-2646, (Feb 1969). 33 p, 4 fig, 4 tab, 8 ref. OWRR Project B-002-TEX.

Descriptors: *Evaporation control, *Greenhouses, Evaluation, *Soil moisture, *Soil water, Hexadecanol, Ions, Alcohols, Texas, Arid lands, Evaporation, Oxides, Loam, Surfactants, Rates of application, Water loss, Moisture content, Data collections, Treatment.
Identifiers: *Crude oil, *Oils, *Hyamine, *Cations, Triton, Latex, Gums, Silicones, Ionic additives, Texas High Plains, Semiarid lands.

These four evaluations trace the progress of greenhouse experiments to suppress evaporation from soils in the Texas High Plains, where 60 percent of the added rainfall and irrigation water evaporates. Suppressants evaluated were crude oil with and without ionic additives, an oil-latex mixture, polyethylene oxides, silicones, polysaccharide-gum mixture, an amonic and a fatty alcohol. Crude-oil contained suppressants had slower initial evaporation rates from soil pots, while other materials were ineffective, Catonic oil, oil-latex mixture, and polysaccharide-gum mixture further suppressed soil water evaporation. The order of cationic oil effectiveness was Hyamine 3500 more than Hyamine 2389 equal to Hyamine 1622 equal to Triton X-400 more than X-150. Hexadecanol suppressed evaporation less than crude oil. Tables and figures illustrate and quantify these results. (Popkin-Arizona)
W71-03485

MEAN EVAPORATION OVER CANADA,
Meteorological Service of Canada, Toronto (Ontario).
H. L. Ferguson, A. D. J. O'Neill, and H. F. Cork.
Water Resources Research, Vol 6, No 6, p 1618-1633, December 1970. 16 p, 10 fig, 2 tab, 19 ref.

Descriptors: *Evaporation, *Synoptic analysis, *Mapping, Water balance, Hydrologic budget, Maps, Hydrologic cycle, Data collections, Meteorological data, Evaporation pans.
Identifiers: *Canada, *Evaporation maps.

Mean monthly and annual maps of evaporation over Canada were prepared. The maps represent time and space averages of evaporation from natural open water bodies having negligible heat storage. The analysis is based on 5-year class A evaporation pan data supplemented by 10-year climatologic data from 100 stations across Canada. The Christiansen formula is shown to be superior to other formulas tested for approximating pan data from other standard climatologic observations. The analysis takes account of the seasonal effects of freeze-up and breakup on the availability of open water. A zonal classification of lake evaporation that emphasizes the large-scale climatic variations in this parameter across Canada is proposed. (Knapp-USGS)
W71-03678

EVAPORATION STUDIES IN STANDARD CATCHMENTS,
Manchester Univ. (England).
H. S. Takhar, and A. J. Rudge.
Journal of Hydrology, Vol 11, No 4, p 329-362, November 1970. 34 p, 15 fig, 6 tab, 9 ref.

Descriptors: *Evapotranspiration, *Evaporation, Meteorological data, Energy budget, Lysimeters, Evaporation pans, Regression analysis, Runoff forecasting.
Identifiers: *Potential evapotranspiration.

When estimates of monthly potential transpiration were obtained from meteorological records using theoretical and empirical methods, conflicting trends are revealed by the Penman combination model and the empirical models used. Estimates from short term records from three standard experimental catchments were compared with each other and with observed estimates obtained from lysimeter and evaporation pan readings. Despite significant random errors, the lysimeter estimates appear to be the best. The empirical models indicate very little, of the spatial variation in potential transpiration shown by the other methods and their usefulness therefore seems to be restricted. The accuracy of the Penman model appears to vary greatly from site to site. (Knapp-USGS)
W71-03698

THE USE OF PANS AND A THEORETICAL MODEL TO DEFINE THE ROLE OF EVAPORATION IN THE WATER BUDGETS OF THE CITY OF LARAMIE AND THE STATE OF WYOMING,
Wyoming Univ., Laramie. Dept. of Civil Engineering.
Dennis J. Brown.
MS Thesis, Wyoming University, June 1970. 133 p, 21 fig, 18 tab, 37 ref, 2 append. OWRR Project A-001-WYO (34).

Descriptors: *Evaporation, *Hydrologic data, *Evaporation pans, *Water balance, *Wyoming, Methodology, Climatology, Hydrologic cycle, Meteorology, Solar radiation, Temperature, Lakes, Surface waters, Water balance, Water loss, Wind velocity, Latent heat, On-site data collections.
Identifiers: *Laramie (Wyo), *Evaporation prediction, *Potential evaporation, *Lake evaporation, *Evaporation-analysis methods (Comparison).

Results of estimates of evaporation obtained by means of the inflow-outflow method, evaporation pans, and theoretical equations are compared. Relative amounts of annual evaporation determined by evaporation pans and by theoretical equations are estimated for locations throughout the State of Wyoming, and are compared to current evaporation maps. The water budget study of the Laramie sewage lagoon system provided evidence that the 0.7 Class A pan coefficient is applicable as a means for determining reservoir evaporation. The model equation for lake evaporation derived by Kohler, Nordenson, and Fox provides a more reliable means of estimation since it corrects the amount of pan evaporation for the effects of advected energy through the pan, and for differences in temperature between the air and the water in the pan. Lake evaporation in the Laramie area is equal to approximately 55 inches per year. The amount is appreciably more than the 38 inches read from current evaporation maps of the United States. (Woodard-USGS)
W71-03729

2E. Streamflow and Runoff

SOME EFFECTS OF HYPOLIMNITIC DISCHARGES ON TEMPERATURES IN THE STREAM BELOW,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-03308

ASYMPTOTIC NONLINEAR WAVE MOTION OF A VISCOUS FLUID IN AN INCLINED CHANNEL OF ARBITRARY CROSS SECTION,
Wisconsin Univ., Madison. Mathematics Research Center.
For primary bibliographic entry see Field 08B.
W71-03309

STREAMFLOW GENERATING TECHNIQUES: A COMPARISON OF THEIR ABILITIES TO SIMULATE CRITICAL PERIODS OF DROUGHT,
California Univ., Los Angeles. School of Engineering and Applied Science.
Arthur J. Askew, William W-G Yeh, and Warren A. Hall.
Univ of Calif, Water Resources Center, Contrib No 131, Report No 70-5, January 1970. 24 p, 1 fig, 3 tab, 18 ref, 2 append. OWRR Project B-061-CAL (5).

Descriptors: *Streamflow, *Simulation analysis, *Droughts, *Rivers, *Computer programs, Reservoirs, Watersheds, Time, Cost, Synthetic hydrology, Statistical models, Reservoir design, Mathematical models, Streamflow, Forecasting.
Identifiers: *Critical periods, Synthetic streamflow records.

A set of monthly streamflow records were generated and analyzed to derive a set of synthetic critical periods. Some characteristics of these

periods were determined, and the mean and standard deviation of their values were compared with the appropriate values for the historic critical period. The procedure was repeated for twenty-six different rivers, using ten generating techniques. A study of the results allowed a comparison to be made between the generating techniques in regard to both their cost in computer time and their ability to synthesize critical droughts by the relative aridity of watershed, and by the size of the reservoir considered. In addition, some general conclusions were drawn regarding the advisibility of using generated streamflow in studies of reservoir design and operation. (Kriss-Cornell)
W71-03314

THE QUASI-PERMANENT REGIME OF RIVERS AND THE PREDICTION OF FLOODS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W71-03327

INSTRUMENTATION AND DEVELOPMENT OF TECHNIQUES TO MEASURE AND EVALUATE METEOROLOGICAL PARAMETERS IMPORTANT TO HYDROLOGY,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 07A.
W71-03375

PROCEEDINGS MISSISSIPPI WATER RESOURCES CONFERENCE, 1970.
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 04A.
W71-03380

HURRICANE CAMILLE ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 07C.
W71-03381

INFLOW OF RIVER WATER TO THE BALTIC SEA IN THE PERIOD 1951-1960,
State Inst. for Hydrology and Meteorology, Warsaw (Poland).
Z. Mikulski.
Nordic Hydrology, Vol 1, No 4, p 216-227, 1970. 12 p, 2 fig, 3 tab, 19 ref.

Descriptors: *Water balance, *Sea water, *Inflow, Hydrologic budget, Streamflow, Snowmelt, Runoff, Precipitation (Atmospheric).
Identifiers: *Baltic Sea.

The inflow of river water to the Baltic Sea is evaluated for the period 1951-60. A proposal is made for a re-evaluation of the estimates for earlier periods and for future computations on a continuous basis. The Baltic Sea received in the period 1951-1960 about 440 cu km of water. The annual discharge into the Baltic corresponds to 2 percent of the total water volume. Studies recently made in Poland indicate that the discharge in the period 1951-1960 was several percent below the long-term average. The greatest inflow of stream water is in spring (April-June) with a maximum in May (14 percent). Minimum inflow, amounting to 50 percent of the maximum values, occurs in winter (November-January), at the period of dominant sea storms. (Knapp-USGS)
W71-03392

AN IMPLEMENTATION OF STAGE-FALL-DISCHARGE RELATIONSHIP ON DIGITAL COMPUTERS,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
Bo Wingard.
Nordic Hydrology, Vol 1, No 4, p 228-234, 1970. 7 p, 1 fig, 3 tab, 3 ref.

Descriptors: *Stage-discharge relations, *Data processing, *Digital computers, Slopes, Open channel flow, Discharge coefficients, Streamflow, Water levels, Mannings equation, Discharge measurement.
Identifiers: Norway.

Discharge conversions on digital computers for gages where a slope-stage discharge relationship is recommended seem to give good results by employment of a relationship between the mean-stage and the friction parameter. The method gave satisfactory accordance between computed and measured discharge. A correction of the friction curve on the basis of later measurement is simple. As with all slope-stage-discharge methods, the discharge measurements have to be made over a sufficiently long mean-stage and discharge interval. (Knapp-USGS)
W71-03393

COMPILATION OF HYDROLOGIC DATA, DEEP CREEK, COLORADO RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-03398

COMPILATION OF HYDROLOGIC DATA, HONEY CREEK, TRINITY RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-03399

COMPILATION OF HYDROLOGIC DATA, GREEN CREEK, BRAZOS RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-03400

PARAMETERIZATION OF OBSERVED HYDROGRAPHS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
Richard N. Downer.
Available from NTIS as PB-196 899, $3.00 in paper copy, $0.95 in microfiche. Vermont University Water Resources Research Center Report 1, December 1970. 57 p, 6 fig, 5 tab, 14 ref, 2 append. OWRR Project No A-008-VT (1).

Descriptors: *Hydrograph analysis, *Statistical methods, *Computer programs, Regression analysis, Routing, Flood forecasting, Computer models, Hydrographs, Mathematical models, Simulation analysis, Data processing, Optimization, Least squares method, Vermont.
Identifiers: *Curve fitting, Sleepan River watershed (Vt.).

A simple transformation of the incomplete gamma function was used to describe single-peaked hydrographs. A weighted least-squares method produces a forced fit of the crest portion of the observed hydrograph. In addition to determining the parameters of the fit with minimum squared deviations, the computer plots the original and fitted hydrographs and calculates statistics to assist in making an objective decision as to the hydrological goodness-of-fit. A good least-squares fit does not necessarily result in a good hydrologic fit. Judgment of goodness-of-fit on the central portion of the hydrograph is aided by a significance test which combines the number of data points with features of the ocular fit (balancing of volumes and minimizing of deviations). The complete goodness-of-fit test assumes that: (1) the assumed model is correct; and (2) if the model is a correct one, there is a close mathematical relation between the observed and fitted data. (Knapp-USGS)
W71-03665

FLOOD REGULATION BY COLUMBI TREATY PROJECTS,
Corps. of Engineers, Portland, Oreg. Water Con trol Branch.
For primary bibliographic entry see Field 04A.
W71-03666

EFFECT OF CHANNEL SHAPE O GRADUALLY VARIED FLOW PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civ and Hydraulic Engineering.
For primary bibliographic entry see Field 08B.
W71-03669

HYDRAULIC JUMP WITHIN GRADUALLY EX PANDING CHANNEL,
Asian Inst. of Technology, Bangkok (Thailand Dept. of Hydraulic Engineering, and Mindana Development Authority (Philippines).
For primary bibliographic entry see Field 08B.
W71-03670

SMALL SAMPLE PROPERTIES OF H AND K ESTIMATORS OF THE HURST COEFFICIEN h,
Thomas J. Watson Research Center, Yorktow Heights, N. Y.; and Geological Survey, Washing ton, D.C.
James R. Wallis, and Nicholas C. Matalas.
Water Resources Research, Vol 6, No 6, p 158 1594, December 1970. 12 p, 21 fig, 8 tab, 10 ref.

Descriptors: *Statistics, *Streamflow, *Time serie analysis, *Correlation analysis, Statistical method Frequency analysis, Stochastic processes, Proba bility, Markov processes.
Identifiers: *Hurst phenomenon, *Potomac River.

Seasonal differences in long-term persistence (greater than 0.5), were found for 25 streams in th Potomac River basin. Two statistics, H and K, use as estimators of h were found to have differin small sample properties. K was found to have le variance but a greater positive bias than H. Hov ever, the Hurst phenomenon, in which H and values differ from the expected values for indepe dent series, was confirmed for the Potomac Riv basin streamflows. Neither marginal distributio nor biased transience appear to be viable explan tions for the differences between observed and i dependent or short memory simulated sequence For the Potomac basin, the explanation of h bein greater than 0.5 can only be attributed to the n ture of the correlation structure of the observed s ries. (Knapp-USGS)
W71-03674

RELIABILITY OF A VARIANCE ESTIMAT OBTAINED FROM A SAMPLE AUGMENTE BY MULTIVARIATE REGRESSION,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 07A.
W71-03675

COMPARING POWER SPECTRA COMPUTE BY BLACKMAN-TUKEY AND FAST FOURIE TRANSFORM,
United States Lake Survey, Detroit, Mich.
Billy L. Edge, and Paul C. Liu.
Water Resources Research, Vol 6, No 6, p 160 1610, December 1970. 10 p, 15 fig, 7 ref.

Descriptors: *Fourier analysis, *Time series anal sis, *Statistical methods, Numerical analys Statistics, Time lag.
Identifiers: *Blackman-Tukey method, *Pow spectrum analysis.

To determine whether the Blackman-Tukey or t fast Fourier transform (FFT) technique should used to compute power spectra, single and cro spectra were computed by each approach to pr vide an empirical means for determining whi should be used. The spectra were computed for fi time series, two sets of which were actual field da

In general the two approaches give similar estimates. For a spectrum with a large slope, the FFT approach allowed more window leakage than the Blackman-Tukey approach. On the other hand, the Blackman-Tukey approach demonstrated a better window closing capability. It is concluded that the Blackman-Tukey technique is more effective than the FFT approach in computing power spectra of short historic time series, but for long records the fast Fourier transform is the only feasible approach. (Knapp-USGS)
W71-03676

A STOCHASTIC MODEL FOR FLOOD ANALYSIS,
Colorado State Univ., Fort Collins.
P. Todorovic, and E. Zelenhasic.
Water Resources Research, Vol 6, No 6, p 1641-1648, December 1970. 8 p, 9 fig, 7 ref. NSF Grants 11444 and 11499.

Descriptors: *Stochastic processes, *Statistical models, *Flood forecasting, Frequency analysis, Time series analysis, Pennsylvania, Probability, Data collections, Hydrograph analysis, Model studies, Mathematical models.
Identifiers: *Stochastic models, *Flood analysis, Susquehanna River (Pa.).

A stochastic model, based on the recent developments in the theory of extreme values, is presented to describe and analyze excessive streamflows. The model is a particular stochastic process defined as the maximum term among a random number of random observations in an interval of time. Since the number of hydrographs peaks that exceed a certain level and the magnitudes of these peaks are random variables, the model seems to conform well to the flood phenomenon. The passage time of the process relevant to the risk evaluation in the design of hydraulic structures is also considered. The results obtained are applied on the 72-year record of the Susquehanna River at Wilkes-Barre, Pennsylvania. Theoretical and observed results agree reasonably well. (Knapp-USGS)
W71-03680

STATISTICAL DECISION THEORY TECHNIQUES FOR THE REVISION OF MEAN FLOOD FLOW REGRESSION ESTIMATES,
Carnegie-Mellon Univ., Pittsburgh, Pa.
Richard M. Shane, and Donald P. Gaver.
Water Resources Research, Vol 6, No 6, p 1649-1654, December 1970. 6 p, 2 tab, 9 ref.

Descriptors: *Flood forecasting, *Decision making, *Regression analysis, *Statistical models, Flood protection, Economics, Time series analysis, Probability, Frequency analysis, Data collections, Peak discharge, Variability.
Identifiers: *Flood analysis, Flood peak forecasting.

Two statistical estimating procedures are presented for using regression information along with direct observations to obtain estimates of the expected value of peak flood discharge rates exceeding a constant base. The first type of estimate represents the minimum mean squared error linear combination of regression and direct estimates, whereas the second is a Bayesian estimate based on an objective prior distribution associated with the regression model. A comparison of combined estimates to regression and direct estimates used alone indicates that a significant reduction in the mean squared error is obtained by using combined estimates. A comparison of the two methods for obtaining a combined estimate indicates that in many cases they both give essentially the same result. (Knapp-USGS)
W71-03681

TOPOLOGICAL AND GEOMETRICAL PROPERTIES OF BRAIDED STREAMS,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 02J.
W71-03683

FLOOD SERIES COMPARED TO RAINFALL EXTREMES,
Pennsylvania State Univ., University Park.
Brian M. Reich.
Water Resources Research, Vol 6, No 6, p 1655-1667, December 1970. 13 p, 9 fig, 5 tab, 14 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, *Peak discharge, *Rainfall intensity, *Statistical methods, Probability, Pennsylvania, Correlation analysis, Variability.
Identifiers: *Flood analysis.

Annual series of maximum instantaneous flood peaks from 26 Pennsylvania watersheds smaller than 200 square miles were analyzed by the Gumbel, log Gumbel, and log Pearson 3 methods. An empirical appraisal of how well each of these mathematical curves fits the data shows the general applicability of the straight Gumbel line. Consistent overestimation of long return period extremes results from using the log Gumbel analysis. Advantages of slight flattening for very rare expectations, which can result from the log Pearson 3 and the types of data sets preventing overestimation, are discussed. Corresponding histories of daily and clock hourly extreme rainfall annual series were compared to flood series for 24 watersheds that had more than one half of their drainage areas within a 14-mile radius of the rain gage. Extreme rains that occur during the spring are more strongly linked to annual floods than yearly maximum rainfalls are. No usable relationship could be found between the extreme value statistics of rainfall and floods. (Knapp-USGS)
W71-03685

MULTIPLE GRAVITY WELLS UNDER TRANSIENT STATES OF FLOW,
North Carolina State Univ., Raleigh.
Abdel-Aziz I. Kashef.
Water Resources Research, Vol 6, No 6, p 1729-1736, December 1970. 8 p, 2 fig, 12 ref.

Descriptors: *Groundwater movement, *Drawdown, *Unsteady flow, *Water wells, Aquifers, Water level fluctuations, Theis equation, Steady flow, Diffusivity, Porous media, Artesian wells, Mathematical studies.
Identifiers: *Multiple-well drawdown.

A method for finding the flow pattern of several wells pumped into an unconfined aquifer under transient conditions is based on the results of the study of individual wells using the relationships between the hydraulic forces. A flow equation called the 'unified well formula' is developed and written in terms of the areas of the pressure head diagrams across vertical sections. The free surface of an individual gravity well is derived in a general procedure similar to that for steady state cases but introducting time effects. The equation can be solved numerically in one iterative cycle at a given time. The results of the analysis of single wells are used to determine the flow pattern of a multiple well system under transient conditions of flow. The restricted superposition principles used in steady state cases are also used for transient flow. Dupuit's assumptions are eliminated and the circumferential velocities are neglected. The derived equations are further investigated at small radii or at large values of time. The equation of the free surface reduces to the same form as that of the corresponding steady state cases. However, the radius of influence, in the transient case, depends on the time and the diffusivity of the flow medium. (Knapp-USGS)
W71-03687

SIMULATION AND EVALUATION OF COMPLEX WATER SYSTEMS OPERATIONS,
Australian National Univ., Canberra.
P. A. P. Moran.
Water Resources Research, Vol 6, No 6, p 1737-1742, December 1970. 6 p, 5 ref.

Descriptors: *Statistical models, *Time series analysis, *Markov processes, Stochastic processes, Simulation analysis, Optimization, Systems analysis, Correlation analysis, Streamflow forecasting, Probability, Variability.
Identifiers: *Streamflow models.

The production of long artificial series of multiple streamflows is considered, taking into account non-normal distributions, serial dependence, seasonal variation, and the correlation between different streams. It is proposed that the distribution of flows for a given stream and month be fitted by gamma type distributions, and that these distributions then be transformed to obtain normally distributed variates. A separate canonical correlation analysis for each successive pair of months yield a nonstationary seasonally varying Markovian process that is then transformed back into the original nonnormal variates. The uses of such simulated series for calculating the probability behavior of a system of dams and for the approximate optimization of their operation is described, together with the estimation of standard errors. (Knapp-USGS)
W71-03688

ON TESTING THAT THE DISTRIBUTION OF EXTREMES IS OF TYPE I WHEN TYPE II IS THE ALTERNATIVE,
Agricultural Univ., Wageningen (Netherlands).
M. A. J. Van Montfort.
Journal of Hydrology, Vol 11, No 4, p 421-427, November 1970. 7 p, 1 fig, 2 tab, 2 ref.

Descriptors: *Statistical methods, *Statistics, *Mathematical studies, Probability, Sampling, Time series analysis, Data collections.
Identifiers: *Extreme value probability.

Distributions of largest extremes are normally used to estimate tail probabilities. When dealing with unlimited extremes, the question arises which type of distributions of extremes is adequate. Sometimes the Gumbel distribution (type I), which can be regarded as a restriction of the log-Gumbel distribution (type II), is used without sufficient support for this choice; estimated extreme tail probabilities can then be more influenced by the choice of the type than by the data. This paper gives a quick test with high power where type I is the null hypothesis and type II is the alternative; it is based on a study dealing with the reduction of power as a consequence of using numerically simplified tests. (Knapp-USGS)
W71-03697

SOME EXTENSIONS OF TWO-STREAMS STORAGE MODEL,
Lancaster Univ., Bailrigg (England).
For primary bibliographic entry see Field 04A.
W71-03699

A SALT TRACING METHOD FOR MEASURING CHANNEL VELOCITIES IN SMALL MOUNTAIN STREAMS,
Maine Univ., Orono; and Sleepers River Research Watershed, Danville, Vt.
For primary bibliographic entry see Field 07B.
W71-03700

SOLUTION OF STEADY FLOW IN OPEN CHANNELS BY GRAPHS,
Tarbela Dam Project, Hazara (West Pakistan).
For primary bibliographic entry see Field 08B.
W71-03702

COMPILATION OF HYDROLOGIC DATA, CALAVERAS CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-03704

THE ALASKAN EARTHQUAKE, MARCH 27, 1964: LESSONS AND CONCLUSIONS,
Geological Survey, Washington, D.C.

Edwin B. Eckel.
For sale by the Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $0.75. Geological Survey Professional Paper 546, 1970. 57 p, 2 fig, 145 ref.

Descriptors: *Earthquakes, *Alaska, *Hydrogeology, Faults (Geology), Fractures (Geology), Floods, Landslides, Land subsidence, Seismic waves, Tsunamis, Waves (Water), Flood damage, Mudflows, Clays, Quick clays.
Identifiers: *Alaska Earthquake (1964).

One of the greatest earthquakes of all time struck south-central Alaska on March 27, 1964. In some coastal areas, local subsidence was superimposed on regional tectonic subsidence to heighten the flooding damage. Ground and surface waters were measurably affected by the earthquake, not only in Alaska but throughout the world. Much new and corroborative basic geologic and hydrologic information was accumulated in the course of the earthquake studies, and may new or improved investigative techniques were developed. Chief among these, perhaps, were the recognition that lakes can be used as giant tiltmeters, the refinement of methods for measuring land-level changes by observing displacements of barnacles and other sessile organisms, and the relating of hydrology to seismology by worldwide study of hydroseisms in surface-water bodies and in wells. The volume closes with a selected bibliography and a comprehensive index to the entire Alaska Earthquake series of U. S. Geological Survey Professional Papers 541-546. (Knapp-USGS)
W71-03706

STREAMFLOW RECORDS OF THE SNOWY MOUNTAINS REGION, AUSTRALIA TO 1965 - VOLUME 1: GENERAL INFORMATION AND MURRUMBIDGEE RIVER BASIN.
Snowy Mountains Hydro-Electric Authority, Cooma (Australia).
For primary bibliographic entry see Field 07C.
W71-03708

STREAMFLOW RECORDS OF THE SNOWY MOUNTAINS REGION, AUSTRALIA TO 1965 - VOLUME 2: UPPER MURRAY RIVER BASIN.
Snowy Mountains Hydro-Electric Authority, Cooma (Australia).
For primary bibliographic entry see Field 07C.
W71-03709

STREAMFLOW RECORDS OF THE SNOWY MOUNTAINS REGION, AUSTRALIA TO 1965 - VOLUME 3: SNOWY RIVER BASIN.
Snowy Mountains Hydro-Electric Authority, Cooma (Australia).
For primary bibliographic entry see Field 07C.
W71-03710

ESTIMATE OF TURBULENCE AND HYDRAULIC RESISTANCES DURING WAVE MOTION IN BODIES OF WATER,
V. A. Znamenskiy.
Trans from Gosudar Gidrolog Inst-Ta, No 169, 1969. Soviet Hydrology: Selected Papers, No 4, p 364-370, 1969. 7 p, 2 fig, 3 tab, 12 ref.

Descriptors: *Turbulent flow, *Waves (Water), *Fluid friction, *Energy dissipation, *Flow resistance, Turbulence, Unsteady flow, Non-uniform flow, Steady flow, Roughness (Hydraulic), Reynolds number.
Identifiers: *Hydraulic resistance.

Studies of the kinematics and of the character of fluid motion in bodies of water show that the main losses of energy in turbulent flow and wave action occur in the bottom layer. The hydraulic resistance coefficient, characterizing energy losses, is determined through the Reynolds number and the relative thickness of the bottom layer. The energy losses and the turbulence of wave flow may be estimated from known wave elements. The relationships obtained can also be used to simulate analogous processes in the laboratory. (Knapp-USGS)
W71-03713

EXPERIMENTAL STUDY OF RAINFALL RUNOFF,
Gidrometeorologicheskii Institut, Odessa (USSR).
For primary bibliographic entry see Field 02A.
W71-03719

ESTIMATION OF DESIGN FLOOD DISCHARGES ESPECIALLY FOR RIVER VALLEY PROJECT IN INDIA,
Ministry of Irrigation and Power (India); and Central Water and Power Commission, New Delhi (India).
P. Ahuja, and R. Shenoy.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 252-258, 1969. 7 p, 1 fig.

Descriptors: *Streamflow forecasting, *Floods, *Design flood, Discharge (Water), Flood plains, Hydraulics, Dams, Bridges, Flood forecasting, Design criteria, Design flow, Peak discharge, Hydraulic design.
Identifiers: *India.

The cause and effects of floods in India are briefly outlined. The need for ensuring safety of hydraulic structures against floods in river valley projects is stressed. The criteria for the estimation of design floods for different types and categories of structures are discussed both when there is enough hydrometeorological data, and in cases when there is lack of data. Particular situations when there is a series of structures on the same river or river system are also considered. Lesser criteria adopted for hydraulic structures other than dams, such as weirs, drainage works, bridges, etc. are also discussed. Special reference has been made to railway bridges regarding which extensive basic studies are being conducted to evolve regional formulas for estimation of design floods in order to determine their waterways. (Knapp-USGS)
W71-03721

ON PRINCIPLES OF ESTIMATION METHODS OF MAXIMUM DISCHARGE,
State Hydrological Inst., Leningrad (USSR).
S. N. Kritsky, and M. F. Menkel.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 29-41, 1969. 13 p, 3 fig, 21 ref.

Descriptors: *Floods, *Analytical techniques, *Estimating, *Flood forecasting, Hydrograph analysis, Discharge (Water), Peak discharge, Rainfall-runoff relationships, Storm runoff, Snowmelt, Statistical methods, Probability.
Identifiers: Flood peak estimation.

To calculate rare extreme discharge without sufficient data, additional information on maximum discharge of similar rivers may be used. Such methods are effective for rivers with moderate variations of annual maxima typical of snowmelt regimes. Theoretical curves of probability distribution can compare the performance of different rivers. Another principal estimation system is based on meteorological data as well as the variability of discharge maxima, displacement, and error of estimation of parameters of the distribution of maximum discharge probabilities. Some basic features of USSR state standardization of evaluation methods for maximum discharges are discussed. (Knapp-USGS)
W71-03722

DETERMINATION OF MAXIMUM POSSIBLE FLOOD FLOW USING THE UNIT HYDROGRAPH AND THE 'MAXIMUM DURATION INTENSITY' CURVE (FRENCH),
Universite Federale du Cameroun, Yaounde.
D. le Gourieres.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 193-201, 1969. 9 p, 6 fig.

Descriptors: *Flood forecasting, *Hydrograph analysis, *Duration curves, Hyetographs, Unit hydrographs, Rainfall-runoff relationships, Probable maximum precipitation, Infiltration, Groundwater movement, Discharge (Water), Peak discharge.
Identifiers: Maximum discharge prediction.

Determining maximum flood discharges on the basis of the unit hydrograph and the rainfall intensity duration curve for the region of the river basin is discussed. For this purpose it is sufficient to plot the 'ranked' unit hydrograph and the 'ranked' hyetogram of the most 'dangerous' storm. Then the corresponding ordinates of the ranked unit hydrograph are multiplied by the ranked hyetogram ordinates. The area contained between the runoff curve and the X-axis represents the possible maximum discharge. In order to derive the probable maximum flood discharge it is sufficient to add the maximum groundwater discharge. (Knapp-USGS)
W71-03723

FLOOD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
I-pai Wu.
Hawaii University Water Resources Research Center Contribution No 13, Project Completion Report, December 1968. 33 p, 11 fig, 2 tab, 19 ref. OWRR Project B-006-HI (1).

Descriptors: *Rainfall-runoff relationships, *Urbanization, *Floods, *Hawaii, *Peak discharge, Hydrograph analysis, Regression analysis, Recession curves, Flood routing, Rational formula, Small watersheds, Time of concentration, Precipitation intensity.
Identifiers: *Flood hydrology, *Oahu (Hawaii).

Hawaiian small watersheds are short and steep. Both of the two hydrograph time parameters, time to peak and recession constant, are short. The shape of the flood hydrograph is a steep triangle and most likely produced by a short duration, high intensity rainfall. Peak discharge equations which are derived by three different approaches, triangular hydrograph, instantaneous unit hydrograph, and overland flow analysis, can all be shown as a simple linear equation. A linearity test between peak discharge and runoff has been made for the small watersheds and a good linear relationship was found between peak discharge and for runoff less than 6 inches. (Knapp-USGS)
W71-03724

SPECTRAL MEASUREMENTS AND GROWTH RATES OF WIND-GENERATED WATER WAVES,
Stanford Univ., Calif. Dept. of Civil Engineering.
Alex J. Sutherland.
Stanford University Department of Civil Engineering Technical Report No 84, August 1967. 64 p, 19 fig, 9 tab, 23 ref. ONR Contract Nonr-225 (71), and NSF Grant GK-736.

Descriptors: *Waves (Water), *Winds, *Hydraulic models, *Frequency analysis, Frequency, Wind velocity, Wavelengths.
Identifiers: *Wind-generated water waves, *Wave tanks, Water wave spectra.

Power spectral density measurements were made of the water surface displacement in a wind-generated wave train. Growth rates of different

vave components were determined from the measured spectra. The resulting values were compared with those predicted by the viscous Reynolds stress mechanism of energy transfer from wind to wave. Where the growth was exponential the theory could be made to predict growth rates successfully at wave numbers less than 15.0 per ft. At higher wave numbers the theory predicted values an order of magnitude larger than those measured. Limited regions of linear growth were found at the lowest wind speed for low frequency components. The scatter in the data did not permit a quantitative comparison with theory to be made for this range. No equilibrium range was found. (Knapp-USGS)
W71-03726

THE EFFECT OF RAINFALL ON THE MECHANICS OF STEADY SPATIALLY VARIED SHEET FLOW ON A HYDRAULICALLY SMOOTH BOUNDARY,
Illinois Univ., Urbana. Dept. of Civil Engineering.
Yong Nam Yoon.
PhD Thesis, Illinois University, 1970. 187 p, 71 fig, 1 tab, 66 ref, 5 append. OWRR Project B-018-ILL (2).

Descriptors: *Rainfall-runoff relationships, *Overland flow, *Hydraulic models, *Sheet flow, Mathematical models, Equations, Rainfall intensity, Boundaries (Surfaces), Runoff, Flow resistance, Channel morphology, Topography, Reynolds number, Flow rates, Steady flow, Turbulent flow, Shear stress, Spatial distribution, Demonstration watersheds, Simulated rainfall.
Identifiers: *Experimental watersheds.

The effect of rainfall intensity, Reynolds number and channel slope on the point mean velocity distribution over the vertical, momentum coefficient, longitudinal relative turbulence intensity profile and local mean boundary shear stress is studied. The local mean boundary shear stress was obtained by two methods: the numerical solution of one-dimensional steady spatially varied flow equation with the water surface profile measured; and by direct measurement using a hot-film sensor. These methods are compared and the validity of a one-dimensional equation is discussed. The law of resistance is also established using correlation analysis and experimental results. The Reynolds number and rainfall intensity are found to be the most significant parameters governing the flow resistance. Mathematical models for the description of the upper and lower portion of a velocity profile are developed and compared with experimental measurements. It was concluded that Reynolds number and rainfall intensity are the most important parameters affecting the boundary shear stress. (Woodard-USGS)
W71-03727

SOLUTION OF THE UNSTEADY FLOW EQUATIONS AND ITS USE IN MODELING THE SURFACE RUNOFF PROCESS,
Utah Water Research Lab., Logan.
Roger A. Amisial, J. Paul Riley, Kenneth G. Bennard, and Eugene K. Israelsen.
Research Project Progress Report to Soil and Water Conservation Research Division, Agricultural Research Service, United States Department of Agriculture, May 1969. 66 p, 12 tab, 46 fig, 52 ref.

Descriptors: *Surface runoff, *Hydrologic models, Simulation, *Analog computers, Infiltration, *Runoff, Rainfall, Watershed (Basins), Precipitation, Convective storms, Water yields, Water yield improvement, Hydrologic relationships, Hydrologic data, Water resources development, Planning.

The flow of water on a watershed is usually unsteady and spatially varied, but can be adequately portrayed by the equations of momentum and continuity, commonly referred to as the unsteady flow equations. Because these equations are quasi-linear, hyperbolic, partial differential equations, they are not easily amenable to solution. Analog computer models of surface runoff generally have been based on simplified forms of these equations. As an improvement of those models, an analog computer solution is presented here for the unsteady flow equations. The solution involves the conversion of the partial differential equations into a differential-difference system, and a consideration of the stability of the difference approach was performed. The analog computer solution is then used to develop a model of surface runoff generated from rainfall on a watershed. Spatial distribution of the watershed parameters is accounted for by dividing the drainage basin into a number of subzones according to its physiography and the rainfall input was made to each subzone. Both the overland and channel flow components are considered in the surface runoff process. Preliminary testing and verification of the model have been made by simulating two runoff events on a subwatershed of the Walnut Gulch experimental watershed near Tombstone, Arizona. (See also W70-05118 and W70-04575)
W71-03776

2F. Groundwater

DELINEATION OF GROUNDWATER FLOW SYSTEMS IN NEVADA,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 04B.
W71-03302

MODEL STUDIES OF SALT WATER INTRUSION,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-03316

DOWSING EXPERIMENTS,
Institute for Industrial Research and Standards, Dublin (Ireland).
For primary bibliographic entry see Field 07C.
W71-03389

CROSS-SPECTRUM ANALYSIS OF GROUNDWATER LEVELS IN AN ESKER,
Stockholm Univ. (Sweden). International Meteorological Inst.
Erik Eriksson.
Nordic Hydrology, Vol 1, No 4, p 245-259, 1970. 15 p, 13 fig, 2 tab, 2 ref.

Descriptors: *Water level fluctuations, *Surface-groundwater relationships, *Time series analysis, Glacial drift, Statistical methods, Frequency analysis, Streamflow forecasting, Water levels, Aquifers, Regression analysis.
Identifiers: *Cross-spectral analysis, Sweden.

A study of 30-year records of precipitation, river water stage, and groundwater levels in the esker area south of Uppsala, Sweden used cross-spectrum analysis to summarize data in coherence graphs for frequencies up to 18 cycles/year and tables of phase shifts for selected frequencies. The coherence between precipitation and the other variables is extremely weak or absent. The river water level and groundwater levels show appreciable coherence relatively independent of frequency, suggesting that variation in groundwater levels runs parallel to variations in river water stage. The coherence between groundwater levels, however, is such that interaction is suggested. The phase shift between river water level and groundwater level is approximately 10-30 days with the groundwater levels lagging. The magnitude of phase shift seems to depend on the distance between ground surface and groundwater level. (Knapp-USGS)
W71-03394

THEORY OF GROUNDWATER FLOW,
Technische Hogeschool, Delft (Netherlands).
A. Verruijt.
New York, Macmillan and Company, 1970. 190 p.

Descriptors: *Groundwater movement, *Soil water movement, Analytical techniques, Seepage, Darcys law, Dupuit-Forchheimer theory, Computer programs, Analog models, Permeability, Viscosity, Flow, Porous media, Aquifers, Model studies.
Identifiers: Finite element method, Textbooks.

The aim of this book is to present the fundamentals of the theory of groundwater flow and the most effective methods for solving groundwater flow problems occurring in practice. Technical and practical aspects are not discussed. Although the book is in principle intended to be an introductory text, some theoretically rather complicated methods, notably the complex variable method, analog methods, and the finite element are included. Among the problems discussed are those connected with seepage through earth dams, underneath hydraulic structures and problems related to the supply of drinking water. In general the problem is to determine the velocity and the pressure of the water in the interior of a soil mass with given boundaries, under certain imposed conditions along these boundaries. Mathematically speaking, the problem is in the class of boundary-value problems. (Knapp-USGS)
W71-03397

GROUNDWATER SYMPOSIUM.

Watson, K. K., editor. Proceedings of Groundwater Symposium held at New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, April 1970. 189 p.

Descriptors: *Water resources development, *Systems analysis, *Groundwater movement, *Hydrogeology, *Conjunctive use, Computer models, Analog models, Model studies, Water management (Applied), Water yield, Aquifers, Reviews, Research and development.
Identifiers: *Australia.

The School of Civil Engineering of the University of New South Wales presents a symposium of 12 papers with particular emphasis on contemporary groundwater studies in Australia. The symposium program was centered on groundwater from unconsolidated sediments, groundwater recharge, systems analysis studies, digital and analog models in groundwater investigations, and conjunctive use of surface water and groundwater. (See also W71-03402 thru W71-03405) (Knapp-USGS)
W71-03401

GROUNDWATER IN UNCONSOLIDATED SEDIMENTS - RECENT DEVELOPMENTS IN NEW SOUTH WALES,
Water Conservation and Irrigation Commission (Australia).
For primary bibliographic entry see Field 04B.
W71-03402

NON-DARCY FLOW IN THE VICINITY OF WELLS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
C. R. Dudgeon, and C. N. Au Au Yeung.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 2, p 13-27, April 1970. 15 p, 6 fig, 14 ref.

Descriptors: *Groundwater movement, *Darcys law, *Dupuit-Forchheimer theory, *Head loss, Hydrodynamics, Flow nets, Turbucent flow, Hydraulic conductivity, Mathematical studies, Permeability, Drawdown, Velocity, Water yield.
Identifiers: *Australia, Finite difference method.

The velocity-hydraulic gradient relationships which are applicable to non-Darcy flow in the vicinity of

wells and their application in determining flow rates and drawdowns are described. Methods available for computing non-Darcy flow nets are discussed and practical difficulties involved in determining the constants in the head loss equation are considered. Determination of drawdowns in wells where non-Darcy flow occurs required the computation of nonlinear flow nets. This may be done on the digital computer using finite difference or finite element methods. Accurate knowledge of the type of material and state of compaction of aquifer and gravel pack materials close to the well is required for the constants in the head loss equation to be accurately determined. The only reliable way at present of determining the constants in the head loss equation is by carrying out permeameter tests. The effect of convergence of the flow on the constants required close attention. (See also W71-03401) (Knapp-USGS)
W71-03403

THEORY AND APPRAISAL OF HYDRAULIC CONDITIONS IN WELLS,
Water Conservation and Irrigation Commission (Australia).
For primary bibliographic entry see Field 08B.
W71-03404

ONE-DIMENSIONAL GROUNDWATER RECHARGE,
New South Wales Univ. Kensington (Australia). School of Civil Engineering.
K. K. Watson.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 4, p 50-59, April 1970. 10 p, 3 fig, 10 ref.

Descriptors: *Infiltration, *Recharge, *Soil water movement, *Instrumentation, *Reviews, Unsaturated flow, Unsteady flow, Porous media, Hydrogeology, Numerical analysis.

The hydrologic significance of water movement in the unsaturated zone is discussed with particular reference to one-dimensional groundwater recharge. The relationships which characterize the hydrologic behavior of unsaturated porous materials and recent instrumentation techniques are briefly reviewed. A numerical solution of the differential flow equation is outlined and its application to finite depth problems is discussed. (See also W71-03401) (Knapp-USGS)
W71-03405

ON SUBSIDENCE OF LOESS SOILS OF THE UKRAINE,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
V. F. Krayev.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 321-324, 1970. 4 p.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.

About 14% of the territory of the USSR and nearly 65% of the Ukraine are covered with loess. Loess has several specific compositional features (predominence of dust fractions, presence of carbonates, poor weathering of the clastogenc material) as well as specific properties (fast loosening, rather high filtration rate, anisotropy of the mechanical properties in vertical and horizontal directions), which cause subsidence. Subsidence is among the most adverse features of loess soils. Experience in the construction and operation of buildings on loess soils furnishes numerous examples of deformation suffered by buildings, industrial installations, and irrigation canals. In several areas of the Ukraine subsidence may be as great as 1.0 to 1.5 meters, with thickness of the loess averaging 20 to 40 meters. Subsidence results both from soaking of the soils from the top and from rise in the groundwater level following flooding of reservoirs. The physical nature of the phenomenon consists in a highly perceptible process of compaction of otherwise insufficiently compact portions of the loess complex due to disintegration of a greater part of structural bonds in the soil by water (or other liquids), which may be both natural or supplemented by the construction weight. (See also W71-03148) (Knapp-USGS)
W71-03406

CONSIDERATION ABOUT THE COMPACTION MECHANISM OF STRATUM LYING AT THE DEEPER HORIZON IN TOKYO LOWLAND,
Hirosaki Univ. (Japan). Dept. of Pedagogics.
Tetsuro Shiobara.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 315-321, 1970. 7 p, 3 fig.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Clays, Aquicludes.
Identifiers: *Tokyo (Japan).

A concept of 'Detour Traveling' is introduced to describe behavior of groundwater and intergranular water within pores of semi-pervious strata or aquicludes undergoing compaction. The Quaternary sediments in the Tokyo Lowland, especially the sediments at deeper horizon, are heterogeneous and frequently discontinuous, and the situation strongly regulates the 'Detour Traveling' effect. The deeper strata account for the greater part of the compaction. The change of groundwater pressure causes ground subsidence. It may be attributed to the compaction of a loose clayey material and to 'Detour Traveling' which expresses the effect of the water flow from the strata and the pressure propagation through the extending 'Arterial Network' of more porous materials. (See also W71-03148) (Knapp-USGS)
W71-03407

SOME PROBLEMS OF TIME-SOIL COMPACTION IN PUMPING LIQUID FROM A BED,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
Z. G. Ter-Martirosyan, and V. I. Ferronsky.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 303-314, 1970. 12 p, 4 fig, 14 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Mathematical studies, Hydrogeology.
Identifiers: *USSR.

One-dimensional and plane axi-symmetrical problems of bed consolidation affected by the weight of overlying formations with different schemes of pumping are solved for the most general case when the bed from which a liquid (oil, water) is pumped is a deformed elastic-creeping porous medium filled with a compressible liquid. The mixture of liquid and gas is taken as a compressible liquid. Soil compaction due to the formation of a cone of depression is also discussed. (See also W71-03148) (Knapp-USGS)
W71-03408

LAND SUBSIDENCE, EARTH FISSURES AND GROUNDWATER WITHDRAWAL IN SOUTH CENTRAL ARIZONA, U.S.A.,
Geological Survey, Phoenix, Ariz.; and Geological Survey, Sacramento, Calif.
H. H. Schumann, and J. F. Poland.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 295-302, 1970. 8 p, 5 fig, 9 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Arizona.
Identifiers: *Pinal County (Ariz).

Land subsidence in western Pinal County, south central Arizona, is related to groundwater withdrawal and resultant water level declines. Differential subsidence and earth fissures have damaged irrigation systems, interstate highways and railroads; and have necessitated rerouting of a proposed aqueduct. Subsidence was first detected in 1948. The maximum documented subsidence from 1948 to 1967 is 2.30 meters. Large-scale pumping for irrigation from wells that penetrate as much as 700 meters of permeable sediments has lowered water levels as much as 61 meters. Net water-level declines correspond with subsidence and water-level fluctuations correlate with sediment compaction and expansion. Measured compaction, 1965-1967, in the upper 253 meters accounts for only 65 percent of measured subsidence. Numerous earth fissures, as much as 12.8 kilometers long, occur in the alluvium and transect natural drainageways. Some of the fissures appear on the periphery of the subsiding areas and may be tensional breaks. (See also W71-03148) (Knapp-USGS)
W71-03409

LAND SUBSIDENCE AND AQUIFER-SYSTEM COMPACTION, SANTA CLARA VALLEY, CALIFORNIA, USA,
Geological Survey, Sacramento, Calif.
J. F. Poland.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 285-294, 1970. 10 p, 5 fig, 10 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Confined water, California.
Identifiers: *Santa Clara Valley (Calif).

Intensive withdrawal of groundwater from the confined aquifer system 240 m thick, in the San Jose area of Santa Clara Valley, California, has drawn down the artesian head as much as 75 m since 1912. Resulting land subsidence, which began about 1915, was 3.9 m in 1967. Periodic releveling of bench marks, core-hole data, and continuous measurements of water-level change and aquifer system compaction furnish quantitative evidence on the response of the system to change in applied stress. The adjusted subsidence-head decline ratio in San Jose for 1920-38 was about 1:10. This ratio can be utilized to estimate ultimate subsidence from subsequent head declines. Compaction records at some sites define the magnitude of excess pore pressures in aquitards; at one site, increasing artesian head by 14 m should stop the subsidence. (See also W71-03148) (Knapp-USGS)
W71-03410

FIELD MEASUREMENT OF AQUIFER-SYSTEM COMPACTION, SAN JOAQUIN VALLEY, CALIFORNIA, USA,
Geological Survey, Sacramento, Calif.
Ben E. Lofgren.

n: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 272-284, 1970. 13 p, 11 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Surveys, California.
Identifiers: *San Joaquin Valley (Calif).

Two types of field measurements have been successfully used to monitor aquifer-system compaction and accompanying land subsidence in California: (1) periodic releveling of a network of surface bench marks, referenced to distant stable bedrock, and (2) continuous recording of vertical shortening of the water-bearing deposits, using extensometers installed in cased wells at selected locations. The compacting deposits of the aquifer system are readily compressible and sensitive to change in overburden stress. Imposed hydraulic stresses, caused by the extracting of fluids, results in immediate strain in the aquifer system. Both elastic compression and inelastic rearrangement of the intergranular structure are caused by a stress increase; however, the elastic expansion during a stress decrease is small compared to ultimate plastic compaction for a comparable stress increase. The subsidence/stress-change ratio ranges from 0.005 to 0.10 feet of subsidence per foot of hydraulic stress change durig the first prolonged cycle of water-level decline. (See also W71-03148) (Knapp-USGS)
W71-03411

ON THE VARIATION OF ARTESIAN HEAD AND LAND-SURFACE SUBSIDENCE DUE TO GROUNDWATER WITHDRAWAL,
Saitama Univ., Urawa (Japan).
Shauzo Komaki.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 256-271, 1970. 16 p, 19 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Yokkaichi (Japan).

In and near Yokkaichi, Japan observation of artesian head and subsidence has been carried out since August 1963. The secular variation of groundwater and land-surface levels is disturbed by oceanic tides, meteorological effects and other factors with periods of about one day or less. In order to obtain the secular variation, these disturbances were eliminated from observed data by Pertzev's method. Secular variation of both the groundwater and the land-surface levels is subject to the influence of groundwater withdrawal. The effective amount of discharge Q was calculated by means of the Theis recovery method. There is a good correlation between Q of one day and the secular value of the groundwater level at 06.00 hours of each following day. There is also a good correlation between Q and the amount of expansion-compaction. (See also W71-03148) (Knapp-USGS)
W71-03412

SOME PROBLEMS AND RESULTS OF LABORATORY AND FIELD INVESTIGATIONS INTO ROCK MOVEMENTS CAUSED BY WATER MIGRATION IN LOOSE GRANULAR GROUNDS IN HUNGARY,
Hungarian Mining Research Inst., Budapest.
Zs. Kesseru.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 249-255, 1970. 7 p, 2 fig, 8 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Analog models, Hydrogeology.
Identifiers: *Hungary.

Some observations are presented on the effect of water migration in loose granular rocks upon the compaction of aquifers based upon recent theoretical research work performed in Hungary. Measuring and estimating rock movements caused by pore water pressure drop in the vicinity of Gyongyosvisonta open pit mine were used for forecasting rock movement in the neighborhood of a thermal power-station and determining the constants necessary for calculating the reduction in porosity caused by secondary consolidation. Laboratory experiments were used for investigating rock movements caused by water migration in loose granular sedimentary rocks. Magnetic photoelastic analog modeling and triaxial filter cells were used for investigating the basic phenomena of rock equilibrium. (See also W71-03148) (Knapp-USGS)
W71-03413

INFLUENCE OF SUBSIDENCE ON BOTH SURFACE AND UNDERGROUND HYDROLOGY (FRENCH),
Ghent Rijksuniversiteit (Belgium).
L. J. Tison.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 242-249, 1970. 8 p, 6 fig.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Land subsidence-streamflow relationships.

The influence of land subsidence on a river is discussed. The discharge of a river usually does not change under the influence of land subsidence. The theorem of the 'surface slope' shows that the absolute water levels are reduced in the zone of subsidence and upstream. However, the reduction of the absolute water level in the zone of subsidence is smaller than the amount of the subsidence and there is therefore a relative rising of the water level. In the case of floods, it is shown that the discharge of the river increases under the influence of subsidence with the following consequences: increase of the water level in the region of subsidence; increase of the absolute water levels downstream of the subsidence but decrease upstream. Debris and silt have more opportunity to deposit in the region of the subsidence. (See also W71-03148) (Knapp-USGS)
W71-03414

GEOLOGICAL AND GEOHYDROLOGICAL PROPERTIES OF THE LAND SUBSIDED AREAS-CASE OF THE NIIGATA LOW LAND,
Ministry of Agriculture and Forestry, Niigata (Japan). Hokuriku Regional Office.
S. Takeuchi, S. Kimoto, M. Wada, H. Shiina, and K. Mukai.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 232-241, 1970. 10 p, 10 fig, 1 tab, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Radioactive dating, Hydrogeology.
Identifiers: Niigata (Japan).

To trace the origin of the land subsidence in the low-land area in Niigata Prefecture, Japan, geological and geohydrological properties of the subsided area were studied. The tests used included micropaleontological analysis, absolute chronology by the radiocarbon method, tritium dating, penetration tests, and exploratory boring. The land subsidence had a close relationship with the chronology and depositional environment of alluvium, and the groundwater was rather old. Land subsidence can be calculated in terms of hydraulic balance of groundwater. (See also W71-03148) (Knapp-USGS)
W71-03415

WATER BALANCE INVESTIGATION BASED UPON MEASUREMENTS OF LAND SUBSIDENCE CAUSED BY GROUNDWATER WITHDRAWAL,
District Water Authority, Pecs (Hungary).
I. Orloci.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 224-232, 1970. 9 p, 5 fig.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Porosity.
Identifiers: *Debrecen (Hungary).

The total water demand of Debrecen, Hungary is supplied from wells tapping a 20-30 m thick coarse sand aquifer of the lower Quaternary at 100-200 m depth. The aquifer is overlain by a fluvial series topped by loess and sand. The first wells were drilled some 70 years ago. The yearly water withdrawal now exceeds 12 million cu m. The piezometric level of this aquifer in the vicinity of the wells has subsided 15-20 m since 1913. Because of water withdrawal, the alluvial layer consolidates and the land subsides. Town survey data are used to compare old and recent measurements. A consolidation data series extending over about 40 years was obtained. The maximum subsidence of land amounts to over 40 mm since 1927. The water balance of the aquifer can be characterized by parameters of the compaction and of the dynamic resource determined by land subsidence data. The maximum degree of compaction (which is equal to the pore volume variation produced by possible consolidation) can be estimated at 4-5% of the pore volume of the layer. (See also W71-03148) (Knapp-USGS)
W71-03416

SIMULATION OF GROUNDWATER BALANCE AS A BASIS OF CONSIDERING LAND SUBSIDENCE IN THE KOTO DELTA, TOKYO,
Tokyo Univ. (Japan). Faculty of Science.
Soki Yamamoto, Isamu Kayane, Shigeru Aoki, and Seietsu Fuji.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 215-224, 1970. 10 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mathematical models, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Model studies, Computer programs.
Identifiers: *Tokyo (Japan), *Koto Delta (Japan).

The major cause of land subsidence in the Koto Delta area, Tokyo is believed to be the heavy withdrawal of groundwater. The rate of subsidence is generally in accord with the rate of change in piezometric surface. To simulate the secular trend of groundwater levels, a two-dimensional diffusion

model of a groundwater basin was adopted. Extraction data and water level histories were collected for the delta area and coefficients of storage and transmissibility were determined by the method of least squares using a digital computer. Most of the pumped groundwater in this area has been supplied not from the recharged groundwater but from that stored in the aquifer. (See also W71-03148) (Knapp-USGS)
W71-03417

GROUND SINKING IN SHIROISHI PLAIN, SAGA PREFECTURE,
Ministry of Agriculture and Forestry, Tokyo (Japan). Kanto Regional Office.
Hisao Kumai, Mitsuo Sayama, Tatsuo Sibasaki, and Kazuharu Uno.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 645-657, 1970. 13 p, 10 fig, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

Shiroishi Plain, Japan, is a deltaic plain of about 8 sq km on the Ariake sea. More than 150 deep wells which have been drilled since 1939 can supply water for irrigation. Wells have a depth ranging from 100-200 m and lift confined groundwater in deposits consisting of complex interfingered silt and gravel beds. The groundwater level declined very fast, and intrusion of saline water and ground sinking occurred. Zonal subsidence was found in this area in 1958 and occurred by the consolidation of alluvial clay. The sinking was found in the whole area of the plain in 1961. Sinking is about 20 cm/year maximum. It is directly proportional to the thickness of alluvial clay and volume of water withdrawn for irrigation. (See also W71-03148) (Knapp-USGS)
W71-03418

EXPERIMENTS ON WATER INJECTION IN THE NIIGATA GAS FIELD,
Geological Survey of Japan, Tokyo.
Yasufumi Ishiwada.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 629-634, 1970. 6 p, 3 fig.

Descriptors: *Withdrawal, *Natural gas, *Injection wells, *Secondary recovery (Oil), *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Niigata gas field (Japan).

Experiments using water injection in the natural gas reservoirs of 'dissolved-in-water type' (confined aquifers with dissolved methane gas) were carried out in Niigata City, Japan from 1960 to 1963. The purpose was to study field practice of water injection aimed at the maintenance of the reservoir pressures. Both degassed formation water drained from a gas-water separator and surface water taken from a river were used for injection fluids. Permeability of the main reservoirs ranges from 10 to 50 darcys. Injectivity index is, in general, less than a quarter of productivity index. Back-washing at adequate time intervals is necessary to continue long-term injection. (See also W71-03148) (Knapp-USGS)
W71-03419

PREDICTION OF FUTURE SUBSIDENCE ALONG DELTA-MENDOTA AND SAN LUIS CANALS, WESTERN SAN JOAQUIN VALLEY, CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
N. Prokopovich.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 600-610, 1970. 11 p, 10 fig, 12 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Delta-Mendota Canal (Calif), *San Luis Canals (Calif), *San Joaquin Valley (Calif).

About 120 miles of the Delta-Mendota and San Luis Canals, California have been affected by subsidence caused by overdraft of groundwater. From 1905 to 1951 piezometric groundwater levels along the alignment declined up to 200 feet. Canal deliveries stopped the overdraft, but continuing readjustment of pore pressures caused some 'residual subsidence' to continue at gradually diminishing rates. The subsidence has affected the downstream 35-40 miles of the canal, locally exceeding 6 feet from 1953 to 1966. Estimates of ultimate future subsidence, varying from traces to 3.6 feet, were derived from bench mark data treated as an exponential decay function. About 80 miles of the San Luis Canal, constructed in 1963-67, are subsiding due to groundwater overdraft. From 1905 to 1962, piezometric levels along the alignment declined up to 470 feet, causing up to 18 feet of subsidence. Hydrocompaction of low-density sediments above the water table occurs in two portions of the San Luis Canal. The phenomena may be related to freezing swelling and following freeze-drying of Pleistocene mudflows. Ultimate amounts of hydrocompaction ranging from traces to 20 feet were calculated from average dry densities of sediments and 'ultimate' density values obtained in a few long-flooded areas. (See also W71-03148) (Knapp-USGS)
W71-03420

AN EXAMPLE OF GROUND SUBSIDENCE ESTIMATION,
Public Works Research Inst., Tokyo (Japan).
Masami Fukuoka.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 595-599, 1970. 5 p, 3 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Tokyo (Japan).

The Koto delta area of the Tokyo Metropolis is a low alluvial land extending for about 5 km from east to west, about 10 km from south to north, with an area of approximately 40 sq km bordered by the River Sumida on the west, and by the Arakawa canal on the east. An external embankment was planned for the purpose of defending this area from floodtide. Before carrying out this undertaking, the estimation of future sinking was necessary. Data available for the estimation were not sufficient. Accordingly, sinking for about 20 years after 1955 was estimated. The estimated amount of sinking was based on the following assumptions: (1) As an initial condition, the water level in the permeable sublayer in the alluvial layer and that in the middle permeable sublayer in the tertiary layer coincide; (2) All of the material in the compacted sublayer in the Alluvium is consolidated clay; (3) As the result of excessive pumping of underground water from the middle permeable stratum in the tertiary layer, the ground sank because of consolidation in the middle clayey sublayer in the Alluvium as well as in the middle permeable stratum of the tertiary layer located at depths of up to 80 m; (4) Where t water level in the middle permeable stratum f below the lower face of the alluvial layer, a mospheric pressure was effective between t lower face of alluvial layer and the water tab Because the void ratio, unit weight, compressi index and coefficient of consolidation before t ground subsidence were not available, the soil co stants acquired by testing of samples obtained fro cores were used without adjustment. (See al W71-03148) (Knapp-USGS)
W71-03421

ANALYTICAL METHODS FOR PREDICTIN SUBSIDENCE,
Woodward-Clyde-Sherard and Associat Oakland, Calif.
Keshavan Nair.
In: Proceedings of the Tokyo Symposium on La Subsidence, Vol 2, International Association Scientific Hydrology and UNESCO, Septemb 1969, Tokyo, p 588-595, 1970. 8 p, 3 fig, 20 ref.

Descriptors: *Numerical analysis, *Subsiden *Land subsidence, *Mining, Mathematical studi Compaction, Damages, Groundwater, Grour water movement, Soil mechanics, Rock mechani Water wells.
Identifiers: *Finite element analysis.

The finite element technique is considered to the most useful technique for application to su sidence problems. This paper deals solely with t problem of subsidence which is a consequence the creation of underground openings. Analyti methods based on the principles of solid mechan and placed within the framework of a good u derstanding of the physical nature of the probl have proved to be the most useful means developing predictive techniques for engineeri problems. The major variables that have to be cluded in formulating a problem for investigati subsidence are: (1) location of the undergrou opening; (2) shape of the opening; (3) the ro profile and geologic conditions; (4) the propert of the rock mass surrounding the opening, and (the initial state of stress in the rock. (See also W7 03148) (Knapp-USGS)
W71-03422

A THEORETICAL APPROACH TO STRES STRAIN RELATIONS OF CLAYS,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
Shojiro Hata, Hideki Ohta, and Sudumu Yoshita
In: Proceedings of the Tokyo Symposium on La Subsidence, Vol 2, International Association Scientific Hydrology and UNESCO, Septem 1969, Tokyo, p 563-572, 1970. 10 p, 6 fig, 8 ref.

Descriptors: *Subsidence, *Land subsiden *Clays, *Consolidation, Aquifers, Compacti Damages, Groundwater, Groundwater moveme Soil mechanics, Rock mechanics, Water we Shear, Strength of materials, Deformation, Elas theory, Rheology.
Identifiers: *Stress-strain analysis (Clays).

The derivations of the stress-volumetric strain re tions for normally and overconsolidated clays described. The volume change of clays caused b change in the stress state of clay elements cons of two components; one is the consolidation co ponent that is induced by the change of hydrosta pressure and the other is the dilatancy compon which accompanies the deformation of clay e ments. The two components of volume cha (consolidation and dilatancy) are not necessa independent of each other; therefore the to volume change induced by the stress change is necessarily equal to the summation of consoli tion and dilatancy. (See also W71-03148) (Kna USGS)
W71-03423

WATER PERMEABILITY AND PLAST INDEX OF SOILS,
Kanazawa Univ. (Japan). Dept. of Engineering.

Yoshichika Nishida, and Seishi Nakagawa.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 573-578, 1970. 6 p, 3 fig, 1 tab.

Descriptors: *Permeability, *Plasticity, Clays, *Rheology, *Subsidence, Aquifers, Seepage, Infiltration, Compaction, Groundwater, Groundwater movement, Soil mechanics, Rock mechanics, Water wells, Plasticity index.
Identifiers: *Permeability (Clays).

The coefficient of permeability of water in clay, on which the rate of consolidation settlement is dependent, can be approximately calculated from its void ratio and plastic index through a simple formula. A linear relationship was experimentally determined relating void ratio of a clay and the logarithmic value of its coefficient of permeability. (See also W71-03148) (Knapp-USGS)
W71-03424

RELATIONSHIP OF CONSOLIDATION CHARACTERISTICS AND ATTERBERG LIMITS FOR SUBSIDING SEDIMENTS IN CENTRAL CALIFORNIA, U.S.A.,
Geological Survey, Denver, Colo. Water Resources Div.
A. I. Johnson, and R. P. Moston.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 579-587, 1970. 9 p, 5 fig, 1 tab, 13 ref.

Descriptors: *Plasticity, *Rheology, *Consolidation, *Clays, *Subsidence, California, Land subsidence, Aquifers, Liquid limits, Atterberg limits, Plasticity index, Seepage, Infiltration, Compaction, Groundwater, Groundwater movement, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *San Joaquin Valley (Calif).

As one phase of research on land subsidence, laboratory analyses were made on many undisturbed cores obtained from sediments in subsiding areas of Central California. In 1948 Terzahi and Peck had presented equations relating compression index or coefficient of consolidation to liquid limit, but present research indicates that the same relationships do not hold for any of the sediments tested from Central California. The compression index could be estimated from liquid-limit data, but the relationship was different for each area of subsidence. Comparison of compression indices obtained from consolidation curves with indices computed from liquid limits showed better correlation for sediments of alluvial and lacustrine origin than for sediments of marine origin. Equations for the relationships were obtained by computer solution of data trends. In all three areas of subsidence, the coefficient of consolidation showed a general decrease for increasing values of liquid limit. However, the relationship could not be estimated with reasonable accuracy because the coefficient for any particular load range could vary through more than one order of magnitude for any given liquid limit. (See also W71-03148) (Knapp-USGS)
W71-03425

VISCO-ELASTIC THEORY OF THE DEFORMATION OF A CONFINED AQUIFER,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yoshiaki Fukuo.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 547-562, 1970. 16 p, 4 fig, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Rheology, *Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Non-Newtonian flow, Plasticity, Viscosity, Confined water.
Identifiers: Japan.

The dynamic theory for the deformation of a granular solid saturated with a liquid, is derived assuming that the liquid filling up the pore space is a Newtonian viscous fluid and the skeleton constituted by solid particles is a linear visco-elastic solid. The theory consists of three fundamental equations, the equations of motion of liquid and skeleton and the equation of continuity between the particles and liquid. In a case where the particle and liquid are taken to be incompressible and the deformation of soil is a quasi-static process, these equations are accepted as the theory of three-dimensional consolidation including Terzaghi's well-known equation as a special case, and are also recognized as the basic equations of motion of confined groundwater in a visco-elastic aquifer. A theoretical example shows rheological deformation of an infinite confined aquifer with uniform thickness caused by pumping up water at a constant rate. (See also W71-03148) (Knapp-USGS)
W71-03426

COMPRESSION OF THE PEAT-BOGS AFTER DRAINING,
A. I. Murashko.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 535-546, 1970. 12 p, 6 fig, 2 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Drying, *Organic soils, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Byelorussia (USSR).

Peat-bogs cover one fourth of the total territory of Byelorussia, or 4.5 million hectares. 70-80 thousand hectares of bogs are drained annually in the Republic for agricultural purposes. Peat compression results in diminishing of drain and canal depths, deformation of canal sections, and alternation of slopes of drain lines and relief. Methods are described for calculating peat compression, developed from solution of the differential equations developed by the author and utilization of data of long-term experiments. Formulas take into account thickness of peat layer and its density, characteristics of draining net system and duration of draining. They make it possible to calculate peat compression at any point of a peat-bog surface. (See also W71-03427) (Knapp-USGS)
W71-03427

SUBSIDENCE OF ORGANIC SOILS IN THE U.S.A.,
Agricultural Research Service, Athens, Ga. Soil and Water Conservation Research Div.
John C. Stephens, and William H. Speir.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 523-534, 1970. 12 p, 5 fig, 17 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Drying, *Organic soils, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Everglades (Fla).

Organic soils subside when drained by shrinkage from drying, loss of groundwater bouyancy, compaction, wind erosion, burning, and biochemical oxidation. Relative loss due to each causative factor depends on soil origin, climate, and land management. Shrinkage rate is proportionate to drainage depth--the lower the water table, the greater the subsidence. Level surveys at 5-year intervals from 1913 to 1968 have established the pattern of subsidence in the Florida Everglades to be initially rapid, mainly from shrinkage and compaction, then declining to a continuous steady rate, primarily from oxidation until underlying mineral material is reached. Arable peats have average sinking rates of 3 cm per year. Predictive studies indicate that Everglades peats will be too shallow for agricultural use by 2,000 A.D. Under similar drainage, organic soils subside faster in warm climates, and lowmoor faster than highmoor peats. To conserve organic soils, water tables should be kept as high as crop and field requirements permit. (See also W71-03148) (Knapp-USGS)
W71-03428

PREDICTION OF HORIZONTAL MOVEMENTS DUE TO SUBSIDENCE OVER MINED AREAS,
California Univ., Los Angeles. Dept. of Engineering.
Kenneth L. Lee, and Michael E. Strauss.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 512-522, 1970. 11 p, 8 fig, 7 ref.

Descriptors: *Subsidence, *Land subsidence, *Mining, Compaction, Damages, Groundwater, Groundwater movement, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Mine subsidence.

Some interrelations between vertical and horizontal movements in ground subsidence problems are summarized. The finite element method of analysis is shown to give a good prediction of the correct nature and magnitude of both vertical and horizontal movements resulting from mining subsidence. Two key features which are essential in order for horizontal movements to develop along with vertical subsidence are: first, the seat of major settlement must be located at some significant depth below the ground surface; and second, there must be significant differential vertical movement across the subsiding area. In subsidence areas where horizontal movement data have been obtained, there is no horizontal movement at the point of maximum subsidence, nor are there any horizontal movements at considerable distances beyond the subsidence zone. At each location the direction of horizontal movement is toward the zone of maximum settlement. The point of maximum movement corresponds to the point of steepest slope of the vertical subsidence profile, and the horizontal strain at this point is zero. The horizontal strain over much of the central part of the subsidence area is compressive, and extension strains develop near the outer edges of the subsidence zone. The point of maximum horizontal strain is located at the point of steepest of the horizontal movement curve. (See also W71-03148) (Knapp-USGS)
W71-03429

GEOCHEMICAL STUDY OF GROUNDWATERS IN THE MATSUSHIRO AREA - PART 2: CHEMICAL COMPOSITION OF GROUNDWATERS,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 02K.
W71-03437

SUBSURFACE DISPOSAL OF LIQUID WASTES IN ONTARIO,
For primary bibliographic entry see Field 05E.
W71-03438

SEISMIC REFRACTION AND ELECTRICAL RESISTIVITY: TOOLS IN GROUNDWATER EXPLORATION,
Iowa State Univ., Ames. Dept. of Earth Science.
For primary bibliographic entry see Field 07B.
W71-03439

GROUNDWATER THERMAL REGIME IN A GLACIAL COMPLEX,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
Myles L. Parsons.
Water Resources Research, Vol 6, No 6, p 1701-1720, December 1970. 10 fig, 30 ref.

Descriptors: *Groundwater, Heat transfer, *Temperature, Hydrologic properties, Depth, Thermal conductivity, Mathematical models, Isotherms, Flow, *Glaciers, Glacial soils.
Identifiers: *Thermal regime, Surface cover.

A simple generalized model of a groundwater thermal regime is examined to develop insight into hydrologic and thermal framework. Numerical simulation of the groundwater thermal regime in a glacial complex in the northern Ontario clay belt and numerical modeling of a hypothetical groundwater basin suggest that groundwater flow has a significant effect on the subsurface temperature field. Borehole temperature measurements reflect the hydrogeologic contrast between the highly permeable eskerine deposits and the adjacent less permeable clay and till strata. The eskerine groundwater is several degrees warmer and possesses lower spatial temperature variations than does the clay-till groundwater. Numerical simulation of the temperature field indicates that the temperature variations are related to differences in thermal conductivities of the flow media, to variations in the magnitude of the groundwater flux between esker and clay-till flow systems, and to spatial variations in the water table temperature. The latter factor probably reflects contrasting surface cover conditions between the sandy eskerine terrain and the organic terrain of the clay plain. Contains 30 references. (Upadhyaya-Vanderbilt)
W71-03464

RELATIONSHIP BETWEEN HORIZONTAL STRAIN NEAR A WELL AND REVERSE WATER LEVEL FLUCTUATION,
Geological Survey, Washington, D.C.
Roger G. Wolff.
Water Resources Research, Vol 6, No 6, p 1721-1728, December 1970. 8 p, 8 fig, 11 ref.

Descriptors: *Water level fluctuations, *Strain, *Compaction, Subsidence, Porosity, Clays, Withdrawal, Shear stress, Hydraulic conductivity, Aquifers, Aquicludes, Pore pressure.
Identifiers: Pore pressure fluctuations.

Measurements of radial surface strains near a pumping well showed compression near the well that changed to tension farther away from the well. A theoretical model is presented. In general, this model reproduces the measured strains. Observations of anomalous increase in pore pressure in a clay adjacent to the pumped aquifer are related to the development of these strains. These increases in pressure are attributed to distortion of the pore space in the clay resulting from the transference of horizontal strain from the aquifer via shear. Applying a conceptual model that permits the transference of strain across confining layers to unpumped artesian aquifers accounts for reverse water level fluctuations. (Knapp-USGS)
W71-03686

SOURCES OF DISSOLVED CARBONATE IN AN AQUIFER FREE OF CARBONATE MINERALS,
Geological Survey, Washington, D.C.; Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W71-03694

THE ALASKAN EARTHQUAKE, MARCH 27, 1964: LESSONS AND CONCLUSIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-03706

2G. Water in Soils

SEEPAGE IN MISSISSIPPI RIVER BANKS; REPORT 1, ANALYSIS OF TRANSIENT SEEPAGE USING VISCOUS FLOW MODEL AND NUMERICAL METHODS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W71-03320

THE USE OF SOIL WATER BALANCE RELATIONSHIPS IN AGROCLIMATOLOGY,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
For primary bibliographic entry see Field 02D.
W71-03346

ONE-DIMENSIONAL GROUNDWATER RECHARGE,
New South Wales Univ. Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03405

ON SUBSIDENCE OF LOESS SOILS OF THE UKRAINE,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
For primary bibliographic entry see Field 02F.
W71-03406

A THEORETICAL APPROACH TO STRESS-STRAIN RELATIONS OF CLAYS,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03423

WATER PERMEABILITY AND PLASTIC INDEX OF SOILS,
Kanazawa Univ. (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03424

STRATIGRAPHY, SEDIMENTOLOGY, AND MOISTURE CONTENTS IN A SMALL LOESS WATERSHED IN TAMA COUNTY, IOWA,
Iowa State Univ., Ames. Dept. of Agronomy.
W. J. Vreeken.
Iowa Academy of Science Proceedings, Vol 75, p 225-233, 1968. 9 p, 5 fig, 1 tab, 2 ref. OWRR Project A-014-IA (2).

Descriptors: *Loess, *Erosion, *Soil water, *Moisture tension, Sedimentation, Particle size, Particle shape, Sampling, Iowa, Hydrogeology, Soil physical properties.
Identifiers: Tama County (Iowa).

Particle-size analyses performed on many samples along a traverse across a first-order watershed in loess and integrated into a lithological profile show a clear vertical tripartition in the loess. Distinct stratification in the middle loess increment is shown by sand lenses and differences in silt fractions. Strong beveling of the strata in the south-facing slope indicates that this slope has experienced a higher rate of erosion than did the north-facing slope. Comparison of the lithological analysis with moisture distributions at different times within a one-year period shows a close relationship between particle-size distribution and moisture content. The explanatory physical phenomena must be moisture-tension relationships. (Knapp-USGS)
W71-03440

ORTHONORMAL FUNCTION TABLES AND THE SEEPAGE OF STEADY RAIN THROUGH SOIL BEDDING,
Iowa State Univ., Ames.
W. L. Powers, Don Kirkham, and G. Snowden.
Journal of Geophysical Research, Vol 72, No 24, p 6225-6237, December 15, 1967. 13 p, 6 fig, 5 tab, 9 ref. OWRR Project B-002-IA (7).

Descriptors: *Soil water movement, *Groundwater movement, *Seepage, *Flow nets, Drainage, Saturated flow, Mathematical studies, Furrow drainage, Furrow irrigation, Data processing, Numerical analysis.
Identifiers: *Computer techniques.

Tables of functions are developed for generating, with the aid of a digital computer, sets of general orthonormal functions useful in solving some potential flow problems. As an example of the use of the tables, a flow problem of seepage of groundwater through soil bedding (which is a series of formed parallel mounds and depressions used in land drainage design when soil overlies an impermeable layer) is solved. Flow nets are presented for a number of geometries for the bedding problem. It is noted that the bedding problem corresponds to the problem of seepage of groundwater into a shallow river between sloping hillsides when horizontal bedrock underlies the river valley. (Knapp-USGS)
W71-03441

EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE THEORY,
Iowa State Univ., Ames. Dept. of Agronomy.
Don Kirkham.
Engineering News, Vol 12, No 1, p 22-39, March 1967. 18 p, 10 fig, 29 ref. OWRR Project B-002-IA (6).

Descriptors: *Dupuit-Forchheimer theory, *Soil water movement, *Groundwater movement, Darcys law, Permeability, Anisotropy, Water levels, Drawdown, Percolation, Infiltration, Drainage, Seepage.
Identifiers: *Seepage theory.

Cutting into a porous medium of a large number of vertical, parallel, infinitely permeable, equally spaced, infinitesimally thin slots produces a fictitious soil that follows exactly and without paradoxes Dupuit's assumptions and hence Dupuit-Forchheimer (D.F.) drainage theory in two dimensions. A soil having these infinitesimally thin slots is designated a D.F. soil. Dupuit's two-dimensional 'parabolic seepage problem' and others, may now be considered as exactly solvable for D.F. soils. For three-dimensional axially symmetric seepage flow, as into wells, the fictitious slots of a D.F. soil become concentric coaxial rings. D.F. streamlines are not horizontal; they converge in a special way. Some differences between the behavior of D.F. soils and real soils are: (1) D.F. theory gives too low a water table, that is, drain spacings must be closer than D.F. theory gives to establish a given water table height; (2) D.F. theory gives a better approximation for flow into ditches than into tiles; (3) D.F. theory fails completely (gives infinite drain spacings) when the impermeable layer is at infinite depth; (4) streamlines in a D.F. soil converge to a plane vertical outflow surface or to a cylindrical vertical outflow surface; and (5) the equipotentials and streamlines in D.F. theory comprise a non-orthogonal flow net. (Knapp-USGS)
W71-03442

FRACTIONATION OF PHOSPHATE IN A MATURITY SEQUENCE OF NEW ZEALAND BASALTIC SOIL PROFILES: I,
Lincoln Coll., Canterbury (New Zealand).
J. D. H. Williams, and T. W. Walker.
Soil Science, Vol 107, No 1, January 1969, p 22-30. 2 tab, 1 fig, 24 ref.

Descriptors: *Phosphates, *Soil profiles, *Soil chemical properties, *Weathering, *Basalts,

aching, Soil water, Calcium, Equilibrium, osphorous, Ammonium salts, Sodium com- unds, Sierozems, Soil horizons, Iron, Aluminum, neralogy, Sampling, Variability.
ntifiers: *Fractionation, *Maturity sequence, ew Zealand, *Occlusion, Chang-Jackson ocedures.

rganic phosphate in 62 horizons from 16 New aland basaltic soils varying in weathering and ching degree was fractionated and studied. d-extractable Ca-P declined, and NH sub 4 F-P reased and then declined with increased athering. Reductant soluble P, secondary OH-P and residual inorganic P increased. First OH-P fraction showed no trend. Fractions, par- ilarly NH sub 4 F-P, reflected soil mineralogy. n- and aluminum-bound phosphate fractions e consistent with the theory that these catego- in freely-drained unfertilized soil consist of sphate ions randomly retained in non-occluded occluded form by Fe- and Al-containing soil. s implies that no absolute distinction can be wn between categories, and that the arbitrari- s of Chang and Jackson-type procedures is her increased when occluded Al-bound sphate is present. A sequential paper (Soil ence, Vol. 107, No. 3) proposes 'maturity uence' related to generalized weathering uence and equilibrium with soil water. Tables w phosphate fraction values and mean values several properties. (See also W71-03483) (Pop- -Arizona)
1-03482

ACTIONATION OF PHOSPHATE IN A TURITY SEQUENCE OF NEW ZEALAND SALTIC SOIL PROFILES: 2,
coln Coll., Canterbury (New Zealand).
. H. Williams, and T. W. Walker.
Science, Vol 107, No 3, March 1969, p 213- . 2 tab, 4 fig, 11 ref.

criptors: *Phosphates, *Soil profiles, *Soil mical properties, *Basalts, *Weathering, ching, Soil water, Equilibrium, Phosphorous, monium salts, Slerozems, Soil horizons, eraiogy.
ntifiers: *Fractionation, *Maturity sequence, ew Zealand, *Occlusion, Chang-Jackson cedures, Apatite, Pedogenesis.

nges in relative amounts of phosphate in tite, organic phosphate, and non-occluded and luded forms of secondary inorganic phosphate ng pedogenesis were illustrated by a 'maturity uence' of 16 New Zealand basaltic soil profiles. iculties in defining these categories and in their surement due to inadequacies in Chang and kson-type procedures are discussed. Mineralog- differences between and within soil profiles partly account for the similarity in organic P NH sub 4 F-P behavior within profiles, but the tionship also reflects equilibrium between or- ic phosphate and non-occluded forms of secon- inorganic phosphate. The hypothesis that sphate in apatite is transformed into occluded sphate by these forms accounted for distribu- changes of phosphate between the fractions increasing profile maturity. The generalized thering sequence and equilibrium with soil er are considered. Tables show phosphate frac- profiles and nomenclature. Figures show mean es of Ca-P, and various P as percentage of total tal inorganic P, phosphate fraction transforma- in acid soils and phosphate fraction magnitude nges. (See also W71-03482) (Popkin-Arizona)
1-03483

REE METHODS OF WATER CONSERVA- N FOR DRYLAND COTTON PRODUCTION,
as Agricultural Experiment Station, College ion.
primary bibliographic entry see Field 03F.
1-03487

STRAW MANAGEMENT-NITROGEN TREATMENT INVESTIGATIONS IN THE CONTINUOUS PRODUCTION OF IRRIGATED WINTER WHEAT,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 03F.
W71-03488

THE CHELATION AND MOVEMENT OF SR89-SR90 (Y90) IN A CALCAREOUS SOIL,
Arizona Univ., Tucson.
Michael F. L'Annunziata, and Wallace H. Fuller.
AEC AT (11-1)-947. Soil Science, Vol 105, No 5, May 1968, p 311-319. 3 tab, 10 fig, 27 ref.

Descriptors: *Strontium radioisotopes, *Chelation, *Radioactive wastes, *Calcareous soils, *Leaching, Soil water movement, Arid lands, Electrophoresis, Radioactivity effects, Color reactions, Calcium, Hydrogen ion concentration, Assay, Stability, Structure, Soil chemistry, Sands, Loam, Southwest U.S., Distribution patterns, Radioisotopes.
Identifiers: *Synthetic chelates, *Natural organic chelates, Phosphomolybdotungstic aicd, HEEDTA, DCyTA, EDTA, EGTA, DTPA.

The influence of synthetic chelating agents on radiostrontium movement through soil with leaching was studied. Phosphomolybdotungstic acid (Folin-Ciocalteau Reagent) was an excellent indicator for chelons, producing a blue color with Nu sub 2 CO sub 3 addition. Color reaction and paper electrophoresis indicated the presence of radionuclide complexes in the soil solution as formed by synthetic chelates. Displacement of Sr 89 from columns of Mohave sandy loam was 19, 38, 44, 47 and 81 percent for HEEDTA, DCyTA, EDTA, EGTA and DTPA. Only 5 percent of the Sr 89 was leached in the absence of synthetic chelates. Natural organic chelates did not influence radiostrontium movement. Tables of stability constants of chelates with Ca and Sr, leaching treatments and carboxyl, chelate and effectiveness of Sr movement interrelationships are presented. Figures show structural formulas; chelation of Ca with synthetic chelates; Sr 89 displacement, movement, percentage and profile distribution; electrophoresis of radiostrontium and displaced soil solution; and general chelating reaction. (Popkin-Arizona)
W71-03495

CESIUM UPTAKE BY SUDANGRASS SEEDLINGS FROM FOUR SOILS IN SOUTHERN CALIFORNIA,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02I.
W71-03496

AN APPARATUS FOR LEACHING SOIL SAMPLES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
B. G. Williams.
Soil Science, Vol 105, No 5, May 1968, p 376-377. 2 fig, 5 ref.

Descriptors: *Leaching, *Equipment, *Infiltrometers, *Permeameters, *Infiltration, *Permeability, Soil physics, Suspension, Hydraulic conductivity, Cation exchange, Tubes, Drainage water, Arid lands, Sampling, Filters, Flow control, Rates of flow.
Identifiers: *Intrinsic permeability, Reverse flow.

Leaching tests are important in determining soil properties in arid lands for agricultural and hydrologic studies. A soil leaching apparatus which controls colloidal material loss is described in this paper. Reverse flow of the extracting solution is the leaching method used. This results in partial suspension of the sample, free access of the solution to all soil particles and avoidance of find particle packing. Leaching tubes are constructed from 'perspex.' Twelve tubes can be arranged to be fed from one manifold with individual stopcocks. A manifold tap reduces the flow when desired. Infiltration, hydraulic conductivity, intrinsic permeability, cation exchange capacity and effect of soil on drainage water may be measured with this apparatus. Two sketches of the leaching tube and apparatus are shown. (Popkin-Arizona)
W71-03497

A SOIL AND VEGETATION PATTERN IN THE SANTA CATALINA MOUNTAINS, ARIZONA,
California Univ., Irvine; and North Carolina State Univ., Raleigh.
R. H. Whittaker, S. W. Buol, W. A. Niering, and Y. H. Havens.
NSF grant. Soil Science, Vol 105, No 6, June 1968, p 440-450. 2 tab, 2 fig, 50 ref.

Descriptors: *Soil texture, *Mountains, *Distribution patterns, *Arizona, *Vegetation, Soil-water-plant relationships, Mexico, Calcium, Magnesium, Potassium, Nitrogen, Biomass, Air temperature, Arid lands, Soil profiles, Elevation, Soil horizons, Slopes, Color, Depth, Sampling, Temperature, Topography, Organic matter, Plant populations, Biological communities, Ecosystems, Sierozems, Fluctuation, Thermocline, Desert plants.
Identifiers: *Santa Catalina Mountains (Arizona), *Desert range, Carbon/nitrogen ratio, Topographic moisture gradient, Elevation gradient.

The Santa Catalina Mountains are a desert range in southeastern Arizona with Mexican affinities in their floras and faunas. Soil characteristics and temperatures and vegetation were studied in a transect across the Santa Catalinas. Trends of interrelated characteristics of plants and soils were observed from high to low elevations: decreasing productivity, biomass and coverage of plant communities; shifts in growth-form composition of communities; decreasing litter cover and organic soil content; increasing annual and diurnal amplitude of soil temperature; decreasing nitrogen content and C/N ratios of soils; increasing pH; and increasing Ca, Mg and K contents. Trends along the topographic moisture gradient paralleled these along parts of the elevation gradient. The elevation and topographic moisture gradients define a pattern of mountain ecosystems, comprising corresponding patterns of climatic and topographic environments, soils and plant communities. Tables show summary of measurements and profile descriptions. Figures show the pattern of plant communities to elevation and topography and soil characteristic trends to elevation. (Popkin-Arizona)
W71-03498

SOIL SALINITY IN THE WEST CENTRAL GEZIRA, REPUBLIC OF THE SUDAN,
Australian National Univ., Canberra. Research School of Pacific Studies.
M. A. J. Williams.
Soil Science, Vol 105, No 6, June 1968, p 451-464. 9 fig, 20 ref.

Descriptors: *Saline salts, *Salts, *Clays, *Soil texture, *Arid lands, Rainfall, Topography, Drainage, Soil chemistry, Salinity, Dunes, Permeability, Evaporation, Electrical conductance, Subsoil, Soil horizons, Maps, Sampling, Depth, Distribution patterns, Sodium, Topsoil, Geomorphology, Surface drainage, Colluvium, Alluvium, Lake shores.
Identifiers: *Republic of the Sudan, *West Central Gezira (Sudan), White Nile (Sudan), Closed depressions, Clay plains, Salinity controls, Extractable sodium, Exchangeable sodium.

Subsoil and topsoil salinity was mapped for 1.3 m. acres of land bordering the White Nile between Khartoum and Rabak, in the Sudan. Salt peaks in the second horizon except in the southern colluvial clays, where it increases with depth. Relationships between salinity and rainfall, soil texture, topography, drainage and soil chemical properties are discussed. Soils are saline in closed depressions and

on the northern clay plains. Soils are non-saline on dunes, recent alluvial terraces and colluvial upland clays. Subsoil salinity is highest around former lake margins, and decreases with increasing elevation. Soil texture, permeability and topography are dominant salinity controls. Rainfall and evaporation have a minor influence on salt distribution in this area. Figures include physiographic and soil maps, topsoil and subsoil electrical conductivity distribution, soil class and electrical conductivity relations, relation between depth and salinity, exchangeable sodium and clay content relationships, and total extractable sodium and electrical conductivity relations. (Popkin-Arizona)
W71-03499

MORPHOLOGY OF THE ARGILLIC HORIZON IN DESERT SOILS OF SOUTHERN NEW MEXICO,
Soil Conservation Service, University Park, N. Mex.
L. H. Gile, and R. B. Grossman.
Soil Science, Vol 106, No 1, July 1968, p 6-15. 2 tab, 7 fig, 15 ref.

Descriptors: *Soil horizons, *Sierozems, *Clays, *Geomorphology, *New Mexico, Carbonates, Montmorillonite, Abrasion, Soil moisture, Energy, Animals, Root systems, Recent epoch, Pleistocene epoch, Calcium carbonate, Arid lands, Sands, Pedocals, Age, Geologic time, Soil types, Depth, Particle size, Soil profiles.
Identifiers: *Argillic horizon, *Authigenic carbonate, *Illuviation, Clay skin.

The argillic horizon in a southern New Mexico desert is affected by anthigenic carbonate, silicate clay and coarse fragments. Prominent horizons occur only in soils of Pleistocene age. Clay skins are not a requirement for an argillic horizon. Many oriented clay bodies are clay skin remnants formed on ped surfaces during Pleistocene pluvial periods and are evidence of an illuvial origin. Clay skins are found on ped surfaces in pipes of overthickened horizons in buried Pleistocene soils. These skins are evidence of clay Pleistocene illuviation. Clay skin preservation through Recent time requires restricted physical disturbance, though authigenic carbonate accumulation, shallowness of horizon and access by roots and fauna, high energy, moisture changes and montmorillinitic clay favor disturbance. Oriented clay coatings are typical of Bt horizons of the area. The coatings are strongly expressed in the silicate clay horizon and are markers of clay illuviation. Expression of argillic horizon is related to soil age, carbonate accumulation horizon, subjection to abrasion during moisture changes and other Pleistocene events. Tables show illustrative soils, geomorphic surfaces, ages and laboratory data for soils. (Popkin-Arizona)
W71-03500

QUANTITATIVE STUDIES OF ROOTS IN SOIL. I. LENGTH AND DIAMETERS OF COTTON ROOTS IN A CLAY-LOAM SOIL BY ANALYSIS OF SURFACE-GROUND BLOCKS OF RESIN-IMPREGNATED SOIL,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Irrigation Research Lab.
F. M. Melhuish, and A. R. G. Lang.
Soil Science, Vol 106, No 1, p 16-22, July 1968. 2 tab, 4 fig, 7 ref.

Descriptors: *Root distribution, *Soil-water-plant relationships, *Resins, *Soil water movement, *Cotton, Soil water, Clay loam, Porosity, Pores, Probability, Analytical techniques, Sampling, Length, Surfaces, Measurement, Instrumentation, Plant growth, Voids, Mathematical studies.
Identifiers: *Derivation, Mean root surface area.

Distribution and measurement of the roots of a cotton plant grown in a drum of clay-loam soil are described in this paper. Core soil samples were oven-dried and vacuum impregnated with a thermosetting polyester resin. Plane surfaces were prepared by surface grinding the cured samples. Root analysis was determined by measurement of voids left in the soil after drying and root shrinkage. A theoretical derivation based on geometrical probability of probable root length per unit soil volume from the numbers of roots intersecting a plane of known area was verified experimentally. The probable root length per unit volume and probable mean root surface area per unit volume were calculated. Root distribution in the drum of soil was expressed quantitatively and reliably. Measurements obtained in this way are to be applied in studies of water movement from soil to plants. Figures show the drum and sampling positions, root number versus root length, root void distribution and root number relation to surface area. There are 4 equations, and a table of root surface area as a position function. (Popkin-Arizona)
W71-03501

CALCIUM ACTIVITY, COMPLEX AND ION-PAIR IN SATURATED CaCO sub 3 SOLUTIONS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02K.
W71-03502

RADIOMETRIC METHODS OF MEASURING THE SOIL MOISTURE CONTENT,
For primary bibliographic entry see Field 07B.
W71-03712

EFFECTS OF PETROLEUM MULCH ON SOIL WATER CONTENT AND SOIL TEMPERATURE,
Oregon State Univ., Corwallis. Dept. of Soils.
Ahang Kowsar.
MS Thesis, Oregon State University June 1968. 103 p, 45 fig, 6 tab, 49 ref. OWRR Project B-001-ORE (2).

Descriptors: *Mulching, *Soil-water-plant relationships, *Soil temperature, *Crop response, Evaporation control, Water conservation, Soil water movement, Soil environment, Laboratory tests.
Identifiers: *Petroleum mulches.

Petroleum mulch applied on the soil surface over a row of planted seeds promotes a more rapid and a more uniform germination of seeds, enhance elongation of seedlings and in some cases increases the yield of the crop. An experiment was designed so that changes in soil temperature and soil water content of mulched and unmulched soil, subjected to the same radiation, could be measured under controlled conditions. Soil at a predetermined water content was packed into boxes. A band of mulch was applied to one side of the slab. The soil was subjected to a temperature cycle by turning on infrared heat lamps at 8:00 A.M., increasing the energy output until 2:00 P.M. and then decreasing the energy output until the lights were turned off at 8:00 P.M. Soil temperatures, water content, and heat flux were measured at regular intervals. The mulch-covered soil was about 5 deg C warmer than the bare soil when the soil temperatures attained maximum value. The bare soil rapidly lost water in the upper 4 cm. The mulch covered soil lost water in the upper cm of soil but gained water deeper. The beneficial effect of petroleum mulch is attributed to improved soil water conditions as well as to improved soil temperature conditions. (Knapp-USGS)
W71-03725

SOIL MATRIC SUCTION CHANGES WITH TIME IN PRESSED SOIL BRIQUETTES,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
Victor C. Fuentes.
MS Thesis, Minnesota University, July 1970. 68 p, 13 fig, 2 tab, 59 ref. OWRR Project B-015-MINN (3).

Descriptors: *Soil water movement, *Compacte soils, *Soil moisture, *Moisture content, Laborat ry tests, Free energy, Time, Soil structure, Soil pr perties, Mass transfer, Crystallizatio Monomolecular films, Dehydration, Soil strengt Soil physical properties, Soil physics.
Identifiers: *Soil matric suction, Clarion loam.

A Clarion loam surface soil was pulverized wh dry to pass a 0.3 mm sieve. Samples were wetted water contents ranging from 0.215 to 0.458 g/g a pressed in a brass chamber at 3.5 Kg/sq cm. At lo water contents (less than 0.258 g/g) there was rapid decrease in soil matric suction with time af pressing, indicating an increase in the free ener state of the water. At higher water contents, t rate of decrease in matric suction was smaller. A water content of 0.258 g/g, suction remained co stant with time. This indicates that at this wat content the crystal internal space had a wat monomolecular layer that kept the surfaces at equilibrium distance. Therefore, there was not mass transfer gradient present. At water conte over 0.258 g/g soil matric suction increased w time. In order to more fully understand the proc of stabilization in newly-formed soil aggregat changes in soil matric suction that come about d ing aging of pressed soil were measured. The ag process suggests a thixotropic reaction in whi water content is known to be an important fact (Woodard-USGS)
W71-03728

2H. Lakes

MINERALIZATION PROCESS OF ORGAN MATTER IN LAKE WATER,
Nagoya Univ. (Japan). Water Research Lab.
For primary bibliographic entry see Field 05C.
W71-03435

CULTURE OF LAKE HERRING IN T LABORATORY,
National Water Quality Lab., Duluth, Minn.
For primary bibliographic entry see Field 05A.
W71-03451

PROPERTIES OF CIRCULATION STRATIFIED LAKES,
Cornell Univ., Ithaca, N. Y. Dept. of Civil gineering.
James A. Liggett, and Kwang K. Lee.
ASCE Proceedings, Journal of the Hydraulics D sion, Vol 97, No HY1, Paper 7793, p 15-29, Jan ry 1971. 15 p, 9 fig, 14 ref.

Descriptors: *Water circulation, *Stratified fl *Lakes, Limnology, Winds, Currents (Wate Water levels, Thermal stratification, Epilimni Hypolimnion.
Identifiers: *Lake circulation.

An approximate method is presented to disp some features of wind-driven circulation i stratified lake. Rotation of the earth is includ but the effects of bottom topography and shorel configuration are ignored. The free surface slo upward in the downwind direction and upwar the right of the wind (in the northern hemisphe whereas the thermocline has the opposite slo The free surface slope is related to the thermoc slope by the density ratio of the stratified lay The crosswind slope is of the order of one-fifth downwind slope for lakes at about the latitude the Great Lakes. These slopes decrease with creasing epilmnion thickness. Higher eddy visco also increases slopes, but decreases the velocitie the epilimnion. Decreased epilimnion veloci result from a smaller epilimnion thickness. (Kna USGS)
W71-03671

FFUSION AND ACCUMULATION OF HLORIDE AND SODIUM IN LAKE ONTARIO, EDIMENT,
epartment of Energy, Mines and Resources, rlington (Ontario). Canada Center for Inland aters.
raham Lerman, and Roland R. Weiler.
rth and Planetary Science Letters, Vol 10, No 1, 50-156, December 1970. 7 p, 4 fig, 1 tab, 17 ref.

scriptors: *Water chemistry, *Bottom sedi-nts, *Lake Ontario, Diffusion, Ion transport, ine water, Sodium, Chlorine, Solutes, Aqueous utions, Water balance, Water analysis, Mud-ter interfaces, Connate water, Path of pollutants. ntifiers: Lake water chemistry.

he upper 30 cm of Lake Ontario sediment cores and Cl are being transferred from the lake water o the sediment. The probable cause of the nsfer is the strong increase in their concentra-ns in the lake during the 20th century. The con-ntration data are compatible with diffusional nsport models. Estimated values of the diffusion efficients in the sediment-pore water column are en. The total amount of each species which has ered and accumulated in the sediment-pore ter column since the concentrations in the lake gan to rise is, for Cl, 2.96 mg per sq cm and for , 1.31 mg per sq cm. The amounts accumulated he sediment are about 1-2% of the amounts of two species now present in the lake water. (K-pp-USGS)
1-03672

OSPHORUS CONTENT IN UNCON-LIDATED SEDIMENTS FROM SOUTHERN KE MICHIGAN,
nois State Geological Survey, Urbana.
primary bibliographic entry see Field 05A.
1-03703

ATER RESOURCES AND LAND USE OF THE RAMID LAKE INDIAN RESERVATION.
sey and Ham, San Mateo, Calif.
primary bibliographic entry see Field 06B.
1-03769

. Water in Plants

ELIMINARY RECONNAISSANCE OF AREAS BE IMPOUNDED IN THE SALT RIVER SIN OF KENTUCKY,
ntucky Univ., Lexington.
is A. Krumholz.
ntucky University Water Resources Institute mpletion Report, February 1970. 8 p, 1 fig, 2 2 ref. OWRR Project No A-019KY (1).

scriptors: *Reservoir sites, *Surveys, *Algae, ological communities, *Kentucky, Data collec-s, Damsites, Investigations, On-site data collec-s, Ecological distribution, Ecosystems, bitats, Plants, Animals, Population.
ntifiers: Salt River basin (Ky).

preliminary reconnaissance of areas to be im-nded in the Salt River basin of Kentucky ex-ded from 1 April through 30 June 1968. Since first impoundment was to be at Taylorsville on Salt River, principal effort was expended in that nage area. A preliminary survey of vascular nts of the area to be inundated by Taylorsville ervoir, Salt River basin, Kentucky was made to ect and catalog specimens of vascular plants, to ct areas for future intensive studies of in-enous plant communities, and to select sites for g-term studies of the effects of inundation. More n 100 species of plants referable to more than families were collected, identified, and loged. More than 50 species are indigenous to area. The area is productive of animals. The in-ebrate and vertebrate faunas are abundant and erse. Preliminary stations for the collections of atic organisms, water samples, and other data germane to the study were established. (Knapp-USGS)
W71-03315

PHOTOSYNTHETIC SYSTEMS OF MEDITERRANEAN-CLIMATE SHRUBS AND TREES OF CALIFORNIA AND CHILE,
Stanford Univ., Calif. Dept. of Biological Sciences.
H. A. Mooney, and E. L. Dunn.
NSF (GB 8184) (GB 5223). American Naturalist, Vol 104, No 939, p 447-453, September-October 1970. 5 fig, 1 tab, 6 ref.

Descriptors: *Photosynthesis, *Leaves, *Root systems, *Habitats, *Water balance, Semiarid climates, Biological communities, Ecosystems, Shrubs, Trees, Xerophytes, Cacti, California, Chaparral, Carbon dioxide, Ecological distribution, Drought tolerance, Drought resistance, Altitude, Environmental effects, Mode of action, Energy budget, Energy conversion, Efficiencies, Light, Temperature, Soil moisture, Gradation, Soil-water-plant relationships, Deciduous trees, Coniferous trees, Wet seasons, Dry seasons.
Identifiers: *Evergreens, *Sclerophyllous plants, *Succulents, *Chile, Assimilation, Mediterranean climate.

Mediterranean-type climatic areas of both California and Chile lie in the same latitudinal zones. Dominant growth forms of the plant communities occur at about the same position along a moisture gradient extending over 80-1600 mm annual precipitation. From wet to dry end of the gradient occur evergreen trees, evergreen shrubs, drought-deciduous shrubs and succulents. Plant cover, stature and evergreen leaf size decrease with increasing aridity. Since these communities from each hemisphere have had different evolutionary histories, convergent evolution suggests limited adaptive options along these climatic gradients. The drought-deciduous plants have photosynthetic rates twice as great as the evergreen species. Further, they are characterized by shallow root systems which more efficiently utilize temporally limited soil moisture and lower foliage densities which eliminate competition for light and facilitate carbon dioxide uptake. When water supplies vanish, the leaves are shed. The low energy costs in leaf production combined with high assimilation capacity result in much more energy available for growth and storage per unit time in contrast with the evergreen species and their small, densely packed, yearround leaves with deep roots utilizing deep soil water. (Casey-Arizona)
W71-03329

THE ROLE OF THE MESOPHYLL CELL WALL IN LEAF TRANSPIRATION,
Australian National Univ., Canberra. Research School of Biological Sciences.
P. G. Jarvis, and R. O. Slatyer.
Planta (Berlin), Vol 90, No 3, p 303-322, 1970. 7 fig, 28 ref.

Descriptors: *Water balance, *Leaves, *Stomata, *Vapor pressure, *Water transfer, Nitrogen compounds, Plant physiology, Saturation, Evaporation, Flow control, Resistance, Moisture stress, Carbon dioxide, Transpiration, Evapotranspiration control, Mode of action, Physiological ecology, Cytological studies, Cuticle, Pores, Diffusion, Hydraulic conductivity, Equations, Moisture content, Cotton, Water vapor.
Identifiers: *Water potential, *Leaf mesophyll, *Leaf flow resistances.

Two main pathways are generally recognized in plant transpiration: movement through cuticles and movement through stomatal pores. Stomatal resistance has generally been considered the limiting factor in transpiration of water-stressed plants but other mechanisms, particularly lengthening of mesophyll cell diffusion pathways, have been considered. The value of the cell wall resistance (r sub w) was determined by calculating and comparing leaf resistances to water vapor diffusion and to nitrous oxide vapor diffusion. The latter will not contain r sub w. The 2 outstanding results were that r sub w values were greater than 2.0 sec/cm and that they increased with increasing transpiration rates and water stress. In the calculations, the same result would be obtained with increasing r sub w or decreasing water vapor concentration at the cell evaporating surface (c sub w). A number of possible mechanisms were considered and it is felt that the most likely is the existence of a zone of low hydraulic conductivity associated with the cutinized outer cell wall layer which leads to decreasing c sub w. It is conceded that the long-standing assumption of uniform saturation vapor pressures at cell wall evaporating sites, may not be true. (Casey-Arizona)
W71-03330

A CRITICAL EVALUATION OF TISSUE-IMMERSION METHODS FOR MEASUREMENT OF PLANT WATER POTENTIAL,
Arizona Univ., Tucson. Environmental Research Lab.
James W. O'Leary.
Ohio Journal of Science, Vol 70, No 1, p 34-38, January 1970. 1 fig, 30 ref.

Descriptors: *Osmotic pressure, *Free energy, *Laboratory tests, *Plant tissues, *Plant physiology, Analytical techniques, Water analysis, Thermodynamic behavior, Physicochemical properties, Equilibrium, Movement, Flow, Moisture uptake, Mode of action, Absorption, Water measurement, Flow measurement, Moisture stress, Measurement, On-site investigations, Infiltration.
Identifiers: *Water potential, *Plant-water relationships, *Tissue-immersion methods.

Water moves into, through and out of plants along free-energy gradients expressed by the term water potential (psi). Since water potential reflects plant water stress, its measurement in the field is desirable. For practical reasons, only methods involving immersion of tissue segments in graded osmotic solutions are possible. Theoretically, equal values should be obtained by measurements of tissue change (length, weight, or volume) and by measurements of solute concentration changes. Cylinders of potato tissue were immersed in sucrose solutions of 1-12 bars osmotic pressure and water potentials were measured by the Schardakow-dye method and the change-in-length method. In 8 of 14 measurements the change-in-length underestimated psi. Errors inherent in the method are discussed. Probably the most crucial error factor is infiltration into intercellular spaces leading to tissue stretching. It is concluded that only the dye method is suitable for field measurements. (Casey-Arizona)
W71-03331

THE BEHAVIOR OF LARREA DIVERICATA (CREOSOTE BUSH) IN RESPONSE TO RAINFALL IN CALIFORNIA,
Oxford Univ. (England). School of Botany.
S. R. J. Woodell, H. A. Mooney, and A. J. Hill.
Journal of Ecology, Vol 57, No 1, p 37-44, March 1969. 2 fig, 3 tab, 15 ref.

Descriptors: *Vegetation, *Xerophytes, *Sampling, *Ecology, *On-site investigations, Arid lands, Environmental effects, On-site data collections, Estimating, Measurements, Probability, Reliability, Statistical methods, Variability, Rainfall, Shrubs, Deserts, Mode of action, Competition, Root systems, Biological communities, California, Density, Crop response, Distribution patterns, Correlation analysis, Spatial distribution.
Identifiers: *Creosote bush.

Creosote bush locations in 8 differing desert areas were sampled and analyzed for spacing regularity. The spatial distribution were then correlated with rainfall. The sampling methods used were either the variance/mean ratio or Pielou's point-to-plant distance method, which uses density estimates and a selection of random points. The results showed a

fairly good correlation of density with annual rainfall. Larrea density seemed independent of other shrubs, although all followed the same general trends. The density of other shrubs was high on coarser soils with moderate rainfall and low on either sandier soils or lower rainfall. Regular distribution in sparse Larrea stands is very likely a result of root competition for available water. The theory of spacing by toxic root secretions was considered and deemed unlikely. (Casey-Arizona)
W71-03334

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. II: FIELD PHYSIOLOGY OF ACACIA CRASPEDOCARPA F. MUELL.,
Western Australia Univ., Nedlands. Dept. of Botany.
Erhart O. Hellmuth.
Journal of Ecology, Vol 57, No 3, p 613-634, November 1969. 10 fig, 6 tab, 29 ref.

Descriptors: *Physiological ecology, *Photosynthesis, *Transpiration, *Water balance, *Xerophytes, Arid lands, Legumes, Water conservation, Solar radiation, Temperature, Osmosis, Desert plants, On-site investigations, Metabolism, Environmental effects, Mode of action, Photoactivation, Cuticle, Drought resistance, Heat resistance, Light, Carbon dioxide, Microenvironment, Stomata, Turgidity, Economic efficiency, Moisture deficit, Semiarid climates, Diurnal, Seasonal.
Identifiers: *Australia, *Acacias, *Phyllodes, *Transpiration ratio, *Water potential, Sclerophyllous plants, Photosynthetic efficiency.

Acacia craspedocarpa is a phyllodinous sclerophyll type xerophyte of Western Australia. As the dry season progresses, the phyllodes turn from green to yellowish and their cuticles thicken and develop and 'epistomal cavity' which reduces to a narrow pore - 3-5 microns wide. Essentially this structure increases resistance to water movement without affecting carbon dioxide assimilation so that photosynthetic efficiency increases throughout the summer. Stomatal closure does not occur even though transpiration decreases with increasing water deficit. This is correlated with a number of other xeric adaptations. Saturation light intensities for photosynthesis were fairly low (about 850-1000 ft. -candles). Once saturation intensities were achieved, both photosynthetic and respiration rates were controlled by phyllode temperatures, which were never greater than 6 degrees C. above air temperature. Therefore, they never reached the point of heat damage. Water deficits reach 33 percent before zero turgor is reached; possibly hydrophilic colloids with imbibitional forces are involved. (Casey-Arizona)
W71-03335

VEGETATION OF THE ERER-GOTA PLAIN, ETHIOPIA,
Haile Sellassie I Univ., Addis Ababa (Ethiopia).
Edward W. Beals.
NSF GB-1694. Journal of Ecology, Vol 57, No 3, p 655-667, November 1969. 4 fig, 3 tab, 24 ref.

Descriptors: *Distribution patterns, *Vegetation, *Biological communities, *Semiarid climates, *Ecological distribution, Shrubs, Trees, Grasses, Data collections, On-site investigations, Ecosystems, Sampling, Data processing, Statistics, Legumes, Plant groupings, Plant populations, Hardpan, Soil moisture, Salinity, Mapping, Environmental effects, Rainfall, Altitude, Nitrogen, Correlation analysis, Frequency analysis, Grasslands.
Identifiers: *Stand arrangement, *Plant associations, *Africa, *Ethiopia, Base exchange capacity, Ordination.

Species and vegetation-type distributional patterns of 6 semidesert plant communities were analyzed by ordination techniques. The study area was the southern Afar Depression of Ethiopia where rainfall estimates are 25-50 cm/year. Data analysis was based largely on Cole's index of association and each species was placed in a 2-dimensional ordination. Coordinates of the ordination were used as adaptation numbers to place each of the 18 stands of vegetation in a 2-dimensional continuum. The following vegetation types were discerned: open grassland, Acacia arabica scrub, A. ehrenbergiana scrub, Cadaba rotundifolia scrub, Tamarix orientalis woodland and A. nubica scrub. In all stands perennial grasses were the dominant cover. The stand ordination maps showed a clearcut separation between the first 3 and the last 3 vegetation types. The break probably results from presence of a hardpan below soil surface in the former stands. The same stands were also much richer in salts. Ecological factors underlying the various distributions are discussed and ordination techniques seem valid. Correlations appear probably between stand arrangement and water level, particularly in view of rainfall and soil moisture retention. Definite correlations were found between stand arrangement and altitude, soil base exchange capacity, and soil N. (Casey-Arizona)
W71-03336

ESTIMATION OF WATER STRESSES IN THE ACTIVE ROOT ZONE OF SOME NATIVE HALOPHYTES IN ISRAEL,
Tel Aviv Univ., (Israel). Dept. of Botany.
Y. Waisel, and G. Pollak.
Journal of Ecology, Vol 57, No 3, p 789-794, November 1969. 2 fig, 2 tab, 9 ref.

Descriptors: *Soil-water-plant relationships, *Halophytes, *Arid lands, *Moisture stress, *Root systems, Physiological ecology, Habitats, On-site investigations, Shrubs, Xerophytes, Biological communities, Laboratory tests, Wilting point, Soil horizons, Soil texture, Niches, Environmental effects, Balance of nature, Water balance, Drought tolerance, Drought resistance, Moisture content, Fluctuation, Monthly, Equilibrium, Plant growth.
Identifiers: *Water potential, *Israel.

Since plant habitats are highly variable, both topographically and in soil layers, root moisture stress determinations by soil sampling are almost impossible. Glass sleeves were installed on branches of naturally growing large halophytic plant species in a saline area near the Dead Sea. Between 6-12 weeks later adventitious root systems developed inside the sleeves and their water potentials equilibrated with the water potentials of the sleeve soils. The adventitious root and ground root water potentials were linearly correlated. Mean water potentials obtained for various months of the year ranged for -0.340-50 bars, depending on the species and ecological niche. The lower stress levels were far beyond the 1-15 bar wilting point usually found in the lab. Depending upon magnitude of annual stress fluctuations and year-round growth, the plants were classified as: (1) poikilohydric drought avoiding - Aeluropus litoralis, (2) poikilohydric drought enduring - Arthrocnemum glaucum and Tamarix jordanis and (3) stenohydric drought enduring - Suaeda monoica and Nitraria retusa. Despite occurring together in the same habitat, Tamarix and Suaeda roots exploited different soil horizons. (Casey-Arizona)
W71-03337

SOLAR RADIATION AND THE USE OF IT BY PLANTS,
Main Geophysical Observatory, Leningrad (USSR).
M. I. Budyko.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 39-53, UNESCO, 1968. 16 fig, 18 ref.

Descriptors: *Distribution patterns, *Solar radiation, *Photosynthesis, *Climatology, *Data collections, Carbon dioxide, Productivity, Temperature, Estimating equations, Environmental effects, Turbulence, Evaporation, Theoretical analysis, Radiation, Infrared radiation, Respiration, Vegetatio
Light, Energy transfer, Measurement, Mode of a
tion, Heat balance, Plant growth, Meteorologi
data, Maps, Networks, Stations, Synoptic analysi
Identifiers: *Agroclimatology, *Actinometric s
tions, *USSR, *Radiation balance, *Assimilation

The world actinometric network numbers o
1000 stations and supplies observational data
the determination of normal values of the radiat
regime for much of the Earth's surface. Compu
tional methods have been devised for calculation
the components of the radiation regime from ba
meteorological data, and calculated values
radiation balance agree within a few percent w
measurements. World maps of total yearly rad
tion, January and July radiation and radiat
balance are presented. World maps of heat balan
components and evaporation are also availab
While year to year values of total radiation a
radiation balance are relatively stable, the variab
ty of shorter time intervals increases considera
A theory of photosynthesis in vegetation
developed which takes into account radiat
penetration and carbon dioxide diffusion. It
pears that under conditions of sufficient
moisture, vegetation cover productivity is m
strongly dependent upon 2 factors--photosynth
cally active radiation and temperature. The ac
mulation of radiation data and studies of empir
relationships between plant productivity and ra
tion and other climatic factors has made it poss
to compile maps of plant productivity and util
tion of solar radiation for various geographical
gions. (Casey-Arizona)
W71-03344

INTERROW WATERSHEDS,
Texas Agricultural Experiment Station, Coll
Station.
For primary bibliographic entry see Field 03F.
W71-03486

**CORN IRRIGATION FIELD STUDY IN N
LESHOE AREA, 1969,**
Texas Agricultural Experiment Station, Coll
Station.
For primary bibliographic entry see Field 03F.
W71-03490

**AN IRRIGATION TREATMENT-YIELD STU
WITH CORN GROWN ON THE TEXAS HI
PLAINS,**
Texas Agricultural Experiment Station, Col
Station.
For primary bibliographic entry see Field 03F.
W71-03492

**CORN DATE-OF-PLANTING AND IRRI
TION TIMING STUDY,**
Texas Agricultural Experiment Station, Col
Station.
For primary bibliographic entry see Field 03F.
W71-03493

**CESIUM UPTAKE BY SUDANGR
SEEDLINGS FROM FOUR SOILS
SOUTHERN CALIFORNIA,**
California Univ., Riverside. Dept. of Soils and F
Nutrition.
Malek T. Kaddah.
AEC contract AT 11-1-34 P 92. Soil Science,
105, No 5, May 1968, p 369-375. 4 tab, 15 ref.

Descriptors: *Soil-water-plant relationships, *C
um, *Sudangrass, *Absorption, *California, Sa
water, Ammonium salts, Potassium compou
Arid lands, Toxicity, Loam, Soil chemistry, C
response, Salts, Ions, Ammonium compounds.
Identifiers: *Neubauer technique, *Seedl
*Cesium chloride.

Cesium uptake by four arid soils in micro
macroamounts with salts was studied by a mod

bauer technique using sudangrass as a testing
t. Little differences were exhibited when Cs ad-
ons ranged from 10 to the minus 7 to 10 to the
us 2 meq/100g soil. Cs toxicity symptoms com-
ced when Cs concentration in the shoots were
to 0.03 meq/Cs/g dry shoots. When Cs was
ed to soils in microamounts (less than 10 to the
us 4 meq/100g) with different salts, Cs availa-
y was influenced by the salt concentration,
cially of K and NH sub 4 salts. When 0.1 meq
l was added to 100 g soil, the Nh sub 4
ancing effect on Cs absorption did not occur.
nder macroconcentration affect K and NH-
availability. For any concentration of Cs
d, the Cs uptake was higher when it was added
rather than before Nh sub 4 or K ions, espe-
y in vermiculitic soils and with increasing Cs
entration. Tables of salt, soil KCl and NH sub
and CsCl effects on Cs uptake by sudangrass
lings are included. (Popkin-Arizona)
-03496

**OIL AND VEGETATION PATTERN IN THE
TA CATALINA MOUNTAINS, ARIZONA,**
ornia Univ., Irvine; and North Carolina State
., Raleigh.
rimary bibliographic entry see Field 02G.
-03498

**NTITATIVE STUDIES OF ROOTS IN SOIL.
ENGTH AND DIAMETERS OF COTTON
TS IN A CLAY-LOAM SOIL BY ANALYSIS
SURFACE-GROUND BLOCKS OF RESIN-
REGNATED SOIL,**
monwealth Scientific and Industrial Research
nization, Griffith (Australia). Irrigation
arch Lab.
rimary bibliographic entry see Field 02G.
-03501

**POTENTIAL USE OF TREE RINGS IN
ROLOGIC INVESTIGATIONS IN EAST-
NORTH AMERICA WITH SOME BOTANI-
CONSIDERATIONS,**
ogical Survey, Arlington, Va.
ard L. Phipps.
r Resources Research, Vol 6, No 6, p 1634-
, December 1970. 7 p, 3 fig, 6 ref.

riptors: *Soil-water-plant relationships,
drochronology, Dating, Climatology, Ecolo-
orests, Lumbering, Growth rates, Paleocli-
logy, Plant growth, Trees.
ifiers: *Tree-ring hydrology.

add a new growth layer, or ring, each year.
use growth is controlled in part by environ-
analysis of tree rings can potentially yield in-
ation concerning past hydrologic (or other en-
mental) conditions. The present state of un-
anding of the relationship between tree
h and the hydrologic environment in the east-
nited States does not allow detailed estimates
t environments from tree rings. It does appear
h, that within the near future it will be possi-
estimate certain hydrologic parameters in
(between gaging stations) from tree growth
omena. For the present, however, examina-
f tree rings is most useful in hydrologic stu-
or dating of events. (Knapp-USGS)
03679

Erosion and Sedimentation

**EFFECT OF RAINDROP IMPACT AND
FACE ROUGHNESS ON SHEET FLOW,**
s Univ., Urbana. Water Resources Center.
rimary bibliographic entry see Field 02B.
03310

**GHTS GAINED FROM RIVER SEDIMEN-
ON MODELS,**
Engineer Waterways Experiment Station,
burg, Miss.

J. J. Franco.
Prepared for presentation at the Hydrologic Engineering Seminar on Sediment Transport in Rivers and Reservoirs, held at Hydrologic Engineering Center, Davis, Calif., April 1970. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper H-70-2, April 1970. 16 p, 6 ref.

Descriptors: *Sedimentation, *Sediments, *Sediment transport, Hydraulic models, Alluvial channels, Rivers.

Movement of sediment in alluvial streams presents many problems that must be considered in the development and improvement of these streams for navigation and flood control. Laboratory investigations have contributed to a better understanding of sedimentation processes, but very little information is available on control of sediment movement in natural streams. The Waterways Experiment Station has conducted a number of studies concerned with the solution of specific problems in unusually troublesome or unstable reaches. Some of these studies and results, summarized in this report, are: Arkansas River development for navigation; movement of sediment between locks and dams; shoaling in lower lock approach; dike systems; bifurcated channels; and open river problems. (Spivey-WES)
W71-03325

GEOMETRIC STABILITY ANALYSIS OF AN ALLUVIAL RIVER,
Corps of Engineers, Vicksburg, Miss. Potamology Section.
For primary bibliographic entry see Field 08B.
W71-03383

CONTROL OF SCOUR AT HYDRAULIC STRUCTURES,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Div.
For primary bibliographic entry see Field 08B.
W71-03384

THE USE OF FALLOUT CESIUM-137 AS A TRACER OF SEDIMENT MOVEMENT AND DEPOSITION,
Agricultural Research Service, Oxford, Miss., Sedimentation Lab.
For primary bibliographic entry see Field 07B.
W71-03385

STRATIGRAPHY, SEDIMENTOLOGY, AND MOISTURE CONTENTS IN A SMALL LOESS WATERSHED IN TAMA COUNTY, IOWA,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03440

EROSION CONTROL ON AIR FORCE BASES,
Water Resources Engineers, Inc., Walnut Creek, Calif.
DeLynn R. Ray, D. F. Kibler, and C. E. Busby.
Available from NTIS as AD-713 644, $3.00 in paper copy, $0.95 in microfiche. Technical note, WLC-TN-70-018, Aug 1970. 25 p, 14 ref. Air Force Contract F29601-69-C-0039.
Identifiers: *Erosion, Control, *Sails, Erosion, *Construction, Military facilities, State-of-the-art reviews, Rainfall, Drainage, Intensity, Exposure, Terrain, Wind, Water, Particles, Air Force Operations.

A state-of-the-art review of the soil erosion field as it relates to the erosion control needsof the US Air Force was conducted. The review will serve as a guide for preparation of a Base Civil Engineer erosion control handbook. Typical military construction activities which have exposed large areas of unprotected soil and subsequently have led to serious erosion problems are presented. Factors involved in the wind and erosion processes are discussed and soil-loss equations and soil erodibility indices are reviewed. The erodibility indices are reviewed. The erodibility K-factor in the ARS soil-loss equation is evaluated for land management planning techniques. Guidelines for effective erosion control practices to protect exposed land surfaces against soil particle detachment and transport by either water or wind are presented. Further efforts to establish a more reliable erodibility index which can be used to define areas of highly erodible soils, especially for subsurface soils that are exposed during construction are indicated.
W71-03530

PROBLEMS IN ACHIEVING SOIL AND WATER CONSERVATION.
National Academy of Sciences, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-03634

SEDIMENT TRANSPORTATION MECHANICS: F. HYDRAULIC RELATIONS FOR ALLUVIAL STREAMS.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY1, Paper 7786, p 101-141, January 1971. 41 p, 10 fig, 2 tab, 64 ref, append.

Descriptors: *Alluvial channels, *Sediment transport, *Bed load, *Sedimentary structures, *Channel morphology, Sedimentation, Streamflow, Fluid friction, Roughness (Hydraulic), Stage-discharge relations, Discharge (Water), Discharge measurement, Velocity.
Identifiers: *Bed forms (Alluvial channels).

The several bed forms found in alluvial streams are described and the theoretical treatment of these forms is outlined briefly. The general problem of flow in alluvial streams is then analyzed in general terms and the variables governing such flows and the seven relationships between them are identified. Among these relationships are the friction factor relation and the sediment discharge relation which are of primary importance to engineers. This analysis serves as an introduction to the main part which deals with prediction of the stage-discharge relation. In this part several of the most important methods of calculating these relations are presented clearly and concisely. The paper will be of interest to many engineers and engineering students not only because it presents practical methods for calculating the relation between discharge, velocity and depth of alluvial streams but also because of the fundamental concepts outlined in it. (See also W71-03668) (Knapp-USGS)
W71-03667

SEDIMENT TRANSPORTATION MECHANICS: Q. GENETIC CLASSIFICATION OF VALLEY SEDIMENT DEPOSITS.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY1, Paper 7815, p 43-53, January 1971. 11 p, 1 fig, 1 tab, 37 ref.

Descriptors: *Sediment transport, *Sedimentary structures, *Classification, *Sediments, *Alluvium, Bed load, Rivers, Alluvial channels, Geology, Sedimentation, Sedimentology, Silts, Gravels, Sands, Sand bars, Deltas.
Identifiers: *Alluvium classification.

Valley fluvial sediment deposits are classified according to origin. All such deposits are intergradational, but most can be classified as dominantly transitory channel deposits, lag deposits, lateral or vertical flood plain accretions, splays, channel fill, or colluvium. Mass movements, especially mudflows but also debris avalanches and earthflows in places, form significant deposits under limited circumstances. Other terms are useful for typical surface forms, subdivisions or associations of types of deposits. Point bars are the most conspicuous forms of lateral accretion. Vertical accretion includes natural levee, backland and backswamp

deposits, although splays are also important in natural levees. Channel fills range from course-grained to fine clay plugs. Alluvial fans and deltas are associations of types of deposits, characteristic of specific topographic situations. Valley plugs are fan-like local concentrations along filled channels, with characteristic splays, but not in typical alluvial fan locations. (See also W71-03667) (Knapp-USGS)
W71-03668

TOPOLOGICAL AND GEOMETRICAL PROPERTIES OF BRAIDED STREAMS,
Virginia Univ., Charlottesville.
Alan D. Howard, Mary E. Keetch, and C. Linwood Vincent.
Water Resources Research, Vol 6, No 6, p 1674-1688, December 1970. 15 p, 6 fig, 3 tab, 27 ref.

Descriptors: *Braiding, *Alluvial channels, *Sediment transport, *Mathematical models, Regime, Channel morphology, Networks, Sediment load, Bed load, Deposition (Sediments), Distribution patterns.
Identifiers: *Topology (Channels).

Strong relationships among dimensionless properties of braided streams indicate that similarity is preserved in streams with the same average number of channels but of different sizes. The degree of braiding in streams, conveniently measured by the average number of channels bisected by lines crossing the channel, increases with the product of discharge and gradient, but decreases with higher variance in discharge. A random walk simulation model of braiding duplicates many of the numerical relationships observed in natural streams, suggesting that most of the downstream variation in the number of channels in braided streams is explainable by local fluctuations in discharge and sediment in transport, as apposed to large-scale factors such as valley constriction. (Knapp-USGS)
W71-03683

VEGETATION AND WATERSHED SHAPE,
Cornell Aeronautical Lab., Buffalo, N.Y.
Thomas R. Magorian.
Water Resources Research, Vol 6, No 6, p 1759-1764, December 1970. 6 p, 4 fig, 6 ref.

Descriptors: *Geomorphology, *Watersheds (Basins), *Vegetation effects, *Statistical models, Channel morphology, Distribution patterns, Topography, Small watersheds, Erosion, Hydraulic models, Simulated rainfall.
Identifiers: *Random walk method, *Stream order, First order drainage basins.

The length L of vegetated first order watersheds developed by fluvial erosion is related to the width W by L — W squared/RU, where R is 3 for converging random walks of step size U, whose observed mean is 3 meters for normal dendritic drainage and 40 meters for basins over 300 meters long that drain directly into third or higher order streams. Bare soil watersheds show the relation L—0.4 W. (Knapp-USGS)
W71-03692

POSSIBLE EFFECTS OF PRECIPITATION MODIFICATION ON STREAM CHANNEL GEOMETRY AND SEDIMENT YIELD,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 03B.
W71-03693

NOTES ON BEACH EROSION IN THE CHARLESTON HARBOR AREA,
Citadel, Charleston, S.C. Dept. of Chemistry.
For primary bibliographic entry see Field 02L.
W71-03701

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 5 AND 6. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, AND MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-03707

SIMULATION OF HORIZONTAL TURBULENT DIFFUSION OF PARTICLES UNDER WAVES,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Stephen P. Murray.
Available from NTIS as AD-700 560, $3.00 in paper copy, $0.95 in microfiche. Louisiana State University Coastal Studies Institute Technical Report No 72, p 446-466, October 1969. 21 p, 11 fig, 4 tab, 19 ref. (Reprinted from Proceedings of 11th Conference on Coastal Engineering, September 1968, London, England, published by American Society of Civil Engineers, 1969.) Contract Nonr 1575 (03) NR 388 002 ONR.

Descriptors: *Waves (Water), *Turbulent flow, *Diffusion, *Sediment transport, *Hydraulic models, Turbulence, Diffusivity, Model studies, Beaches, Settling velocity, Suspension.
Identifiers: *Turbulent diffusion.

By oscillation of an array of turbulence-generating grids in still water, the turbulent fluid velocity field in shoaling waves near the bottom was simulated in a laboratory channel. Solid particles with fall velocities varying between 1 and 40 mm/sec were introduced into the test volume from above. Multiple-image photography recorded the grain trajectories. The Lagrangian intensities of turbulence and diffusion coefficients were directly measured from the photographic data. The scale times, scale lengths, and the frequencies of the power spectra modes can then be calculated. The turbulent velocity distributions of both fluid and heavy particles are Gaussian, and their standard deviations increase regularly with increasing grid Reynolds numbers. Diffusion coefficients also increase with increasing grid Reynolds numbers. Diffusivities of the heavy particles are a function of both particle fall velocity and the structure of the fluid turbulence. (Knapp-USGS)
W71-03714

COLLECTIVE MOVEMENT OF SEDIMENT IN LITTORAL ENVIRONMENT,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Choule J. Sonu.
Available from NTIS as AD-700 560, $3.00 in paper copy, $0.95 in microfiche. Louisiana State University Coastal Studies Institute Technical Report No 71, p 373-400, October 1969. 28 p, 16 fig, 35 ref. (Reprinted from Proceedings of 11th Conference on Coastal Engineering, September 1968, London, England, published by American Society of Civil Engineers, 1969.) Contract Nonr 1575 (03) NR 388 002 ONR.

Descriptors: *Sand waves, *Sediment transport, *Beaches, Waves (Water), Littoral drift, Currents (Water), Bed load, Sands, Surf, Ocean waves, Sedimentation, Topography, Sand bars, Sedimentary structures.
Identifiers: *Sand waves (Beaches).

Collective movements of sediment occur in the form of sand waves in the nearshore zone and affect beach topography to a significant extent. Bar-type sand waves move only in the onshore direction and account for various accretive profiles on the subaerial beach. When the beach is eroded, these sand waves are simply disintegrated on the subaerial beach, instead of migrating back in the form of sand waves. These characteristics of bar-type sand waves help explain dynamic behavior of beach profiles with respect to profile configuration, sediment storage, and beach width. Cusp-type sand waves are considered to be a product of interaction between longshore currents and an erodible bed. Their presence causes variability in beach profiles along the shore between those containing a prominent bar and those without a bar. Migrati
of these sand waves may well produce pulsatio
transfer of material along the shore. (Knap
USGS)
W71-03715

**BRIDGE DESIGN CONSIDERING SCOUR A
RISK,**
Arizona Univ., Tucson; and Bureau of Pu
Roads, Washington, D.C.
For primary bibliographic entry see Field 08A.
W71-03739

**THE 1966 GUERNSEY RESERVOIR SEDIME
SURVEY,**
Bureau of Reclamation, Denver, Colo. Office
Chief Engineer.
Joe M. Lara.
Available from NTIS as PB-195 013, $3.00
paper copy, $0.95 in microfiche. Bureau of Re
mation Report REC-OCE-70-22, July 1970. 5
29 fig, 8 tab, 9 ref.

Descriptors: Sediment distribution, *Reservoir
ing, Sedimentation, *Reservoir surveys, Ra
lines, Wyoming, Deltas, Contours, Degradat
Sediment production, Fluvial hydraulics, Sedim
transport, Gamma rays, Sonar, *Sedim
sampling, Field investigations, Unit wei
Watersheds (Basins), Radioactivity.
Identifiers: *Reservoir capacity, Gamma pro
Guernsey Reservoir (Wyo), Sediment deposits.

The 1966 sediment survey of Guernsey Reser
was made to determine the present reser
capacity and the quantity of sediment accumul
since the dam was closed in 1927. Present capa
of the reservoir is 45,228 acre-ft and the sur
area is 2,377 acres at normal water surface el
tion 4420 ft. The total volume of sediments a
mulated in the reservoir amounted to 28,582 a
ft below elevation 4420 ft. Sediments accumul
at an annual rate of 719 acre-ft between 1927
1966. Twenty-one sediment samples of reser
deposits were collected and a gamma probe
used to measure wet bulk densities of t
deposits at 20 reservoir ranges. Analyses of sam
collected in 1947, 1957, and 1966 showed
average unit weight of 54 lb/cu ft. Size analys
samples collected during the 3 surveys resulte
an average breakdown of 43% clay, 44% silt,
13% sand. A sonic depth recorder was use
make the hydrographic survey. The rese
capacity was computed on the basis of areas d
mined by a width ratio method.
W71-03768

2K. Chemical Processes

**ANALYSIS OF SOLUTIONS FOR SURFACE
TIVE AGENTS,**
Kentucky Water Resources Inst., Lexington.
tucky Univ, Lexington. Dept. of Chemistry.
Henry H. Bauer.
Available from NTIS as PB-196 660, $3.0
paper copy, $0.95 in microfiche. Kentucky W
Resources Institute Project Completion Re
Research Report No 39, 1970. 17 p, 4 tab, 2
OWRR Project A-014-KY (1).

Descriptors: *Analytical techniques, Poll
identification, *Electrochemistry, Aqueons
tions, Electrolysis, *Salts.
Identifiers: *Tensammetry, *Surface active ag

The objective was to obtain a better understa
of the behavior of surfactants in aqueous solu
at electrodes. With this understanding it shou
possible to design electrochemical methods f
detection, identification, and quantitative
mination of such substances. This study was
cerned primarily with the influence of extra
salts on the behavior of surface active agents
these are examined by the electroche
technique known as tensammetry. The tensam

ethod consists essentially of the measurement
electrical impedance of an electrochemical
This impedance is characteristically increased
presence of surfactants at those potentials
the surfactants are absorbed on the elec-
At sufficiently negative and at sufficiently
e polarization, surfactants are absorbed, and
se absorption potentials, the impedance of
ell is decreased. Curves of admittance as a
on of polarization of the electrode therefore
y show two tensammetric waves. The extent
face activity is proportional to the separation
en the two tensammetric waves, to the
s of these waves, and to the degree to which
mpedance is increased at polarizations
en the two waves. Since tensammetric mea-
ents can be made only in solutions of suffi-
high conductivity, the nature and effects of
salts on the result obtained is a considerable
tance. In this study it was found that the salt
is relatively unimportant when the salt con-
tion is not greater than approximately 0.1 m.
oncentration might then be used as a stan-
condition for making measurements of the
tant concentration in aqueous solution. The
ability of the technique to the analysis of sur-
ctive agents under actual field conditions was
empted.
)3305

**CE FOR FIELD DETERMINATION OF
Y METALS IN NATURAL WATERS,**
Univ., Urbana. Water Resources Center.
mary bibliographic entry see Field 05A.
3311

**FERENCE STUDIES IN THE DETER-
TION OF SODIUM, POTASSIUM, CALCI-
AND MAGNESIUM IN NATURAL
RS BY ATOMIC ABSORPTION SPEC-
HOTOMETRY,**
ltural Research Service, Oxford, Miss., Sedi-
ion Lab.
IcDowell, and M. E. Ryan.
ceedings Water Resources Conference, Mis-
State University, State College, April 14-
70, published by Mississippi State Univ
Resources Research Institute, p 163-180,
18 p, 8 fig, 2 tab, 25 ref. OWRR Project A-
ISS (6).

ptors: *Analytical techniques, *Water analy-
ectrophotometry, Chemical analysis, Flame
netry, Ionization, Chemical reactions, Sodi-
tassium, Calcium, Magnesium.
ers: *Atomic absorption spec-
tometry, *Spectrophotometry (Atomic ab-
n).

nic absorption spectrophotometry, signifi-
nization errors were encountered using the
tylene flame in determining Na, K, and Ca in
waters. The alkali metals, Na and K,
e the absorption of each other because of
w ionization potentials. Ca and Mg were
slightly in an oxidizing flame, causing an
n the determination of Na and K. The ab-
n of Mg was not affected significantly by the
ce of 500 ppm Na, K, or Ca. As little as 200
s reduced the ionization errors caused by
Ca, and Mg to an acceptable level (2%) for
analyses. An ionization suppressant should
be added to both standard and sample solu-
hen analyzing samples containing variable
ts of the alkali and alkaline earth metals.
ould be done even with the air-acetylene
The use of an ionization suppressant with
ter flames is much more desirable than using
nperature flames, with their more serious
al interferences. (See also W71-03380). (K-
SGS)
3386

**NAL VARIATION OF THE SOLUTE
ENT AND THE Sr-87/Sr-86 RATIO OF
THE OLENTANGY AND SCIOTO RIVERS AT COLUMBUS, OHIO,**
Ohio State Univ., Columbus, Ohio. Dept. of Geology; and Ohio State Univ., Columbus, Ohio. Water Resources Center.
Rene Eastin, and G. Faure.
Ohio Journal of Science, Vol 70, No 3, p 170-179, May 1970. 10 p, 4 fig, 2 tab, 17 ref. OWRR Project No B-004-Ohio (2).

Descriptors: *Solutes, *Water quality, *Ohio, *Water chemistry, Surface waters, Calcium, Sodium, Potassium, Strontium radioisotopes, Limestones, Discharge (Water), Streamflow.
Identifiers: *Scioto River (Ohio), *Olentangy River (Ohio).

Concentrations of sodium, potassium, calcium, and strontium were determined in water samples collected from the Olentangy and Scioto Rivers at Columbus, Ohio, during 1966. The water samples were collected at weekly intervals throughout the year and were combined into four-week composites. The average concentrations in the Olentangy River (in units of micrograms/ml) were: Na, 22.3; K, 3.3; Ca, 72.4; Sr, 0.923. In the Scioto River the concentrations of these elements were: Na, 12.2; K, 3.6; Ca, 78.8; Sr, 1.91. In both rivers the concentrations of sodium and strontium decreased linearly with increasing discharge, whereas the concentrations of potassium and calcium did not. The concentration of potassium increased steadily during the summer and reached a peak in the fall. The Sr-87/Sr-86 ratio of the Olentangy River decreased with increasing discharge from 0.7116 to 0.7088 while that of the Scioto River appeared to be constant at 0.7093. (Knapp-USGS)
W71-03390

VACUUM UV ABSORPTION SPECTRA OF LIQUID WATER AND ICE,
Ryumyo Onaka, and Tsutomu Takahashi.
Journal of Physical Society of Japan, Vol 24, No 3, p 548-550, March 1968. 3 p, 5 fig, 18 ref.

Descriptors: *Water properties, *Absorption, *Spectroscopy, *Ultraviolet radiation, Crystallography, Hydrogen bonding, Physical properties, Spectrometers.
Identifiers: *Ultraviolet spectrometry (Water).

Fundamental absorption bands of ice and liquid water were studied. Cubic ice has a well-defined absorption band at about 8.7 eV, while hexagonal and amorphous ices show only a gradual increase of absorption intensity toward the higher energy in the range from 7 to 10 eV. Absorption coefficient of liquid water is found to comply with the Urbach rule at the low energy tail of the fundamental absorption. (Knapp-USGS)
W71-03431

SOLUBILITY AND DISSOLUTION RATE OF AMORPHOUS SILICA IN DISTILLED AND SEA WATER AT 20 DEG C,
Nagoya Univ. (Japan). Water Research Lab.
Kikuo Kato, and Yasushi Kitano.
Journal of the Oceanographical Society of Japan, Vol 24, No 4, p 147-152, August 1968. 6 p, 4 fig, 1 tab, 18 ref.

Descriptors: *Aqueous solutions, *Silica, *Water chemistry, *Sea water, *Solubility, Solutes, Hydrogen ion concentration, Chemical properties, Saturation, Salinity.
Identifiers: *Silica solubility.

The solubility of amorphous silica in sea water is about 85 mg per liter at 20 deg C, which is less than that in distilled water (about 113 mg per liter). The dissolution rate seems to be controlled by the amount of silica gel present and its solubility. Silica gel in sea water is transformed to dissolved silica at a much faster rate than in distilled water. A maximum value of dissolved silica is observed during the process of dissolution without abrasion, when the dissolution rate is very large. The differences in the solubility and in the dissolution rate of amorphous silica in distilled and in sea water cannot be explained by the difference in pH values of the waters but seem to be related to the salts present in sea water. (Knapp-USGS)
W71-03436

GEOCHEMICAL STUDY OF GROUNDWATERS IN THE MATSUSHIRO AREA - PART 2: CHEMICAL COMPOSITION OF GROUNDWATERS,
Nagoya Univ. (Japan). Water Research Lab.
Yasushi Kitano, Ryuma Yoshioka, Setsuo Okuda, and Kazuo Okunishi.
Kyoto University Disaster Prevention Research Institute Bulletin, Vol 18, Part 1, No 133, p 49-58, May 1968. 10 p, 7 fig, 8 ref.

Descriptors: *Earthquakes, *Water quality, *Springs, *Water sources, *Water chemistry, Geology, Hydrogeology, Landslides, Water circulation, Aquifers, Groundwater, Groundwater movement, Geochemistry.
Identifiers: *Japan, *Matsushiro (Japan).

A hydrological survey and chemical analysis of groundwaters in the Matsushiro area between September 1966 and February 1968 was made to study chemical quality changes caused by the earthquakes of 1965. Water balance and chemical composition of groundwaters in the area show that groundwaters have a deep source and that they are not influenced by recent precipitation. There is a general tendency for the concentrations of calcium and chloride ions, among dissolved ions, to increase with time. A positive relationship between the activity of the swarm earthquakes, the amount and the concentration of the chemical composition of groundwaters in the area was observed. Many of the springs which gushed out accompanying the heavy earthquakes and landslides disappeared entirely after a decrease in their discharge, whereas large amounts of water are still discharging from some springs. (Knapp-USGS)
W71-03437

STREAM TEMPERATURE STUDY, NORTH FORK SNOQUALMIE RIVER, WASHINGTON,
Washington Univ., Seattle. Charles W. Harris Hydraulics Lab.
E. Ronald Nece.
OWRR Project A-012-WASH (1). State of Washington Water Research Center, Completion Report, January 1968. 49 p, 10 fig, 4 tab, 11 ref. Technical Report No 23.

Descriptors: *Water temperature, *Micrometeorology, *Streams, *Solar radiation, *Air temperature, Hydrology, Groundwater flow.
Identifiers: *Stream water temperature, *Groundwater temperatures.

The upper basin of the North Fork of the Snoqualmie River was used to study stream temperatures in the headwater regions of a typical Pacific Northwest mountain River. One objective was to see if relatively simple calculation methods could be devised for formulating predictions of stream temperature in the upper reaches of such rivers. This involved consideration of the temperature of the groundwater flow. Measurements of air temperatures and of solar radiation in the test basin were performed and a check was made to verify the assumption that these variables may be predicted on the basis of conventional data obtained from regional weather stations. Field data obtained and attempts to develop a computational procedure for predicting stream temperature variations as function of assumed climatological conditions and streamflows are described. The question of transferral of some climatological data from one area to another was checked in more detail; results are presented and discussed. (Herrera-Vanderbilt)
W71-03481

FRACTIONATION OF PHOSPHATE IN A MATURITY SEQUENCE OF NEW ZEALAND BASALTIC SOIL PROFILES: I,
Lincoln Coll., Canterbury (New Zealand).
For primary bibliographic entry see Field 02G.
W71-03482

FRACTIONATION OF PHOSPHATE IN A MATURITY SEQUENCE OF NEW ZEALAND BASALTIC SOIL PROFILES: 2,
Lincoln Coll., Canterbury (New Zealand).
For primary bibliographic entry see Field 02G.
W71-03483

SIGNIFICANCE OF SILICA IN THE LOSS OF MAGNESIUM FROM IRRIGATION WATERS,
California Univ., Riverside.
Frank M. Eaton, G. W. McLean, G. S. Bredell, and H. E. Doner.
Soil Science, Vol 105, No 4, April 1968, p 260-280. 10 tab, 3 fig, 53 ref. California Water Resources Center Project W202.

Descriptors: *Calcium, *Magnesium, *Silica, *Drainage water, *Irrigation water, Water quality, Chlorides, Runoff, Sulfates, Saline soil, Carbonates, Alkalinity, Ion exchange, Sodium, Solubility, Groundwater, California, Rio Grande, Silicates, Arid lands, Rivers, Chemical precipitation, Hydrogen ion concentration, Saline water, Surface waters, Water chemistry, Water analysis, Analytical techniques, Data collections, Electrical conductance.
Identifiers: *Soil solution, *River water.

In this article illustrations show that the tendency for Ca/Mg ratios in saline soil solutions and drainage waters in similar to those in irrigation supplies, though Cl concentrations may increase with runoff. Ca is lost to CaSO sub 4 and CaCO sub 3 precipitation while Mg is lost to silicates as an alkalinity and an ionization function through an increase in Na and CaCO sub 3 precipitation in the alkalinity source. Variations in SiO sub 2 solubilities in river and groundwaters as influenced by discharge, time and temperature are discussed for a California watershed. Tables show silica and average ionic concentrations in the Rio Grande drainage basin; silica, Cl and Ca/Mg ratios for selected sites; long term silica and electrolyte concentrations in California rivers; effects of HCO sub 3 and SiO sub 2 and Ca and Mg precipitation; serial additions of sodium nitrate and silicate effects; pH ranges on sodium carbonates and silicates; factorial summary of Mg losses; and sea water effects. Also included are figures of Mg solubilities in SiO sub 2, SiO sub 2 in Mg as influenced by pH, concentration and time, and solubilities of Mg and SiO sub 2 in MgCl sub 2 and Na sub 2 SiO sub 3. (Popkin-Arizona)
W71-03494

SOIL SALINITY IN THE WEST CENTRAL GEZIRA, REPUBLIC OF THE SUDAN,
Australian National Univ., Canberra. Research School of Pacific Studies.
For primary bibliographic entry see Field 02G.
W71-03499

CALCIUM ACTIVITY, COMPLEX AND ION-PAIR IN SATURATED CaCO sub 3 SOLUTIONS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
F. S. Nakayama.
Soil Science, Vol 106, No 6, p 429-434, November 1968. 3 tab, 1 fig, 21 ref.

Descriptors: *Calcium, *Calcium compounds, *Calcium carbonate, *Equilibrium, *Stability, Ions, Solutes, Solubility, Soil water, Sierozems, Calcareous soils, Arid lands, Chemical reactions, Hydrogen ion concentration, Soil chemistry, Equations.
Identifiers: *Calcium activity, *Ion activity, Partial pressure.

The behavior of all soil-related Ca compounds is of vital interest to soil scientists, particularly those studying arid and calcareous soils. This paper reports on the different forms of Ca that may be in equilibrium with CaCO sub 3 with their appropriate dissociation or association constants. Constants related to each of the species are K sub 1 equals 0.0564 for the relation positively monovalent CaHCO sub 3 equals positively divalent Ca plus negatively monovalent HCO sub 3, K sub 2 equals 1.245 times 10 to the seventh for CaCO sub 3 plus positively monovalent H equals positively monovalent CaHCO sub 3, and K sub 4 equals 0.329 times 10 to the minus four for CaCO sub 3 equals positively divalent Ca plus negatively divalent CO sub 3. In saturated CaCO sub 3 solution under partial pressure conditions resembling that of atmospheric CO sub 2, suitable correction must be employed to get the actual positively divalent Ca concentration when the Ca activity cannot be measured directly. Activity, concentration and equilibrium values are given in tables. There are 9 equations and a plot of experimental data testing the estimation of the equilibrium equation. (Popkin-Arizona)
W71-03502

MEMBRANE FOULING AND STUDIES ON NEW ELECTRODIALYSIS MEMBRANES,
Negev Inst. for Arid Zone Research, Beersheba (Israel).
For primary bibliographic entry see Field 03A.
W71-03522

DIFFUSION AND ACCUMULATION OF CHLORIDE AND SODIUM IN LAKE ONTARIO, SEDIMENT,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 02H.
W71-03672

SOURCES OF DISSOLVED CARBONATE IN AN AQUIFER FREE OF CARBONATE MINERALS,
Geological Survey, Washington, D.C.; Geological Survey, Denver, Colo.
F. J. Pearson, Jr., and Irving Friedman.
Water Resources Research, Vol 6, No 6, p 1775-1781, December 1970. 7 p, 2 fig, 2 tab, 14 ref.

Descriptors: *Water chemistry, *Carbonates, *Groundwater, *Provenance, *Stable isotopes, Water sources, Recharge, Infiltration, Groundwater movement, Solutes, Aquifers.
Identifiers: *Long Island (NY).

Water from 14 wells in the Magothy aquifer, Long Island, New York, was sampled for chemical analysis and C-13/C-12 ratio measurements of the dissolved carbonate. The Magothy is essentially free of carbonate minerals and contains water whose chemistry is controlled by the chemistry of the atmospheric precipitation that recharged the aquifer. Wells near the recharge area have delta C-13 values of -2.5% and total carbonate contents corresponding to a PCO2 of about 0.004 atmosphere, showing that the carbonate here is derived from the soil zone. Downgradient, the total carbonate content doubles, but the delta C-13 values remain more negative than -1.8%. The dissolved carbonate increase is due in part to carbonate mineral solution but results largely from oxidation of lignite in the aquifer by oxygen dissolved in the water. (Knapp-USGS)
W71-03694

A PORTABLE, AUTOMATIC WATER SAMPLER,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W71-03695

PHOSPHORUS CONTENT IN UNCO SOLIDATED SEDIMENTS FROM SOUTHER LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05A.
W71-03703

QUALITY OF SURFACE WATERS OF TH UNITED STATES, 1965: PARTS 5 AND 6. HU SON BAY AND UPPER MISSISSIPPI RIVE BASINS, AND MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-03707

2L. Estuaries

MODEL STUDIES OF SALT WATER INTR SION,
North Carolina State Univ., Raleigh. Dept. of C Engineering.
Abdel-Azis I. Kashef.
Water Resources Bulletin, Vol 6, No 6, p 944-9 November-December 1970. 24 p, 14 fig, 10 tab, ref. OWRR Project A-007-NC (6).

Descriptors: *Saline water intrusion, *Grou water movement, *Hydraulic models, Model s dies, Porous media, Viscosity, Hydroynam Hydraulic similitude, Soil water moveme Laboratory tests, Saline water-freshwater int faces, Steady flow, Unsteady flow.
Identifiers: *Hele-Shaw models.

Model studies are used to verify theories in grou water flow systems. In complex cases, the mo studies may be extremely useful especially whe theoretical rigorous analysis does not exist. models cannot be considered entirely satisfact due to the several drawbacks in each type in ac tion to the normal human errors in experimer tion. This paper is concerned with viscous fl models. A brief summary of the other types models, which may be possibly be used in conn tion with salt water intrusion problems, is a given. Gravity flow systems are analogous to so phases of salt intrusion problems. Problems in fields bear general similarities to sea water int sion zones. In oil fields, gas cycling studies g valuable information to sea water problems. Mo studies are used by hydraulic engineers, geologi petroleum engineers, physicists, foundation gineers and several other professional groups. napp-USGS)
W71-03316

TIDAL PRISM MEASUREMENTS AT MOU OF COLUMBIA RIVER; HYDRAULIC MOD INVESTIGATION,
Army Engineer Waterways Experiment Stat Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-03324

RELATIONSHIP BETWEEN POLLUTION DICATOR ORGANISMS AND THE SALIN OF MISSISSIPPI'S ESTUARINE WATERS,
Gulf Coast Research Lab., Ocean Springs, Miss.
For primary bibliographic entry see Field 05A.
W71-03387

A CONTROLLED DEPTH, VOLUMETRIC B TOM SAMPLER,
For primary bibliographic entry see Field 05A.
W71-03449

TEMPERATURE STUDIES OF AN INT TIDAL ZONE OF AN ESTUARY,
Central Electricity Generating Board, London gland).
For primary bibliographic entry see Field 05B.
W71-03467

TED STATES V STEWART (LAND SCRIBED AS BOUND BY THE WATER'S GE IS THAT LAND ABOVE THE MEAN H WATER MARK).
primary bibliographic entry see Field 06E.
-03524

ID WAVES AND TIDAL CHANNELS IN THE RRANCE TO CHESAPEAKE BAY,
Dominion Univ., Norfolk, Va. Inst. of anography.
n C. Ludwick.
ilable from NTIS as AD-713 195, $3.00 in er copy, $0.95 in microfiche. Technical Report l, September 1970. 107 p, 32 fig, 57 ref. ONR Number NR388098.
tifiers: *Estuaries, Sand, *Tides, Chesapeake Sedimentation, Floods, Ocean waves, Fluid , Interactions, Hydrographic surveying, ythermograph data, Tidal channels, Shoal elopment.

l waves 5-12 feet in height and 200-1200 feet ngth occur in water 25-50 feet deep in the sand and tidal channel area of the entrance to sapeake Bay. Most waves are asymmetrical in sverse profile, some facing with ebb currents, rs facing with flood currents, depending which ominant at a given place. Steep slopes on the ous waves range from 4 deg to 31 deg and age 12 deg. The sand waves occur in associa- with tidal channels and especially on the flanks oals that form channel boundaries. Migration nd waves, judged from their facing direction, is d sediment transport mechanism by which sand oved up onto shoals. Many large shoals of the occur between ebb-dominated and flood- inated channels. This implies the existence of circulation loops of water and sediment in cells ted ober shoals. The action of such cells is to sediment. Other ebb-flood shear zones may sites of future shoaling in the entrance.
-03529

ES ON BEACH EROSION IN THE CHAR- TON HARBOR AREA,
del, Charleston, S.C. Dept. of Chemistry.
. Wagener.
h Carolina Division of Geology, Environmen- eology Series 1, 1970. 11 p, 2 fig, 1 map.

criptors: *Beach erosion, *South Carolina, sion control, Coastal engineering, Shore pro- on, Surveys, Littoral drift, Provenance, Sedi- t transport, Surf, Recreation.
tifiers: *Charleston Harbor (SC).

ier islands, such as the Isle of Palms, Sullivan's d and Folly Island, all near Charleston Harbor, h Carolina, change significantly in configura- over periods of several decades. Retreat of the d as a result of beach erosion causes loss of and property damage almost immediately. ion arrestment structures such as the Folly d groins, the Isle of Palms groin, and the emer- y seawall of the Isle of Palms have generally mplished the purposes for which they in- ed. Beach erosion and outbuilding of beaches irectly related to the supply and distribution of by waves, longshore and other offshore cur- , and tidal currents. South Carolina coastal rs are sufficiently shallow that changes in posi- of currents, scour channels, offshore bars, could be monitored by use of conventional and white stereoscopic aerial photography. ograph studies could be backed up by in situ surement of current velocities, rates of sand sport, etc. (Knapp-USGS)
-03701

LECTIVE MOVEMENT OF SEDIMENT IN TORAL ENVIRONMENT,
siana State Univ., Baton Rouge. Coastal Stu- Inst.
primary bibliographic entry see Field 02J.
-03715

MARINE AQUACULTURE,
National Science Foundation, Washington, D.C. Office of Science Information Service.
Tadashi Tamura.
Trans of mono Suisan Zoshokuga Ku, Tokyo, 1966. Available from NTIS as PB-194 051, $15.00 in paper copy, $0.95 in microfiche. 2nd ed., 1970. 1125 p.
Identifiers: *Aquaculture, Books, Fisheries, Shallow water, Ecology, Larvae, Growth, Culture media, Food, Marine fishes, Crustacea, Reptiles, Aquatic animals, Cephalopoda, Gastropoda, Echinodermata, Algae, Translations, Japan.

Marine aquaculture and the promotion of coastal fisheries; The present state of marine aquaculture; Techniques in shallow sea cultivation; Environmental factors in marine quaculture; Ecological factors in the propagation of marine organisms; Artificial hatching, Rearing larvae; Culture ponds; Food; Marine organisms aquacultured in Japan; Propagation of reptiles; Propagation of marine fishes; Propagation of ascidians; Propagation of crustaceans; Propagation of cephalopods; Propagation of gastropods; Propagation of bivalves; Propagation of echinoderms; Propagation of other marine animals; Propagation of algae.
W71-03772

MAINE LAW AFFECTING MARINE RESOURCES, VOLUME III: REGULATION OF THE COAST: LAND AND WATER USES.
Maine Univ., Portland. School of Law.
For primary bibliographic entry see Field 06E.
W71-03785

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

POWER, WATER AND FOOD FOR DESERT COASTS: AN INTEGRATED SYSTEM FOR PROVIDING THEM,
Arizona Univ., Tucson.
Carl H. Hodges, and Carle O. Hodge.
66th Annual Meeting, American Society for Horticultural Science, Pullman, Washington, August 20-22, 1969. Typescript 20 p.

Descriptors: *Desalination, Waste disposal, Water sources, *Desalination plants, Heat, Environment, Environmental engineering, Ecology, Biological communities, *Coasts, Deserts, *Arid lands.
Identifiers: Waste heat utilization.

Of the world's 20,000 miles of arid coastline, a large percentage remains berefit of cultivation. Considerable portions of these sparse areas could be made productive if the basic amenities of life were present. On this premise, investigations were started in November 1966 on possible designs for an economical package for power-water-food production in such locations. An integrated, closed-environment system has been devised. Waste heat from engine-driven electric generator sets is used to desalt seawater. This fresh water, in turn, is utilized for the irrigation of vegetables planted within greenhouses of air-inflated plastic. High-quality vegetables have been grown in a pilot facility on the Gulf of California while planning has begun for the first large-scale installation--in the Arabian Peninsula Shaikdom of Abu Dhabi. The concept is believed to be widely applicable. (Novotny-Vanderbilt)
W71-03465

ADVANCED WASTE TREATMENT BY DISTILLATION,
Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
For primary bibliographic entry see Field 05D.
W71-03509

COST OF PURIFYING MUNICIPAL WASTE WATERS BY DISTILLATION,
Delaware Univ., Dover.
For primary bibliographic entry see Field 05D.
W71-03510

MEMBRANE FOULING AND STUDIES ON NEW ELECTRODIALYSIS MEMBRANES,
Negev Inst. for Arid Zone Research, Beersheba (Israel).
F. de Korosy, A. Suszer, E. Korngold, M. F. Taboch, and M. Flitman.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 605, December 1970. 102 p, 17 fig, 6 tab, 38 ref. OSW Contract 14-01-0001-1734.

Descriptors: Desalination, *Membrane processes, *Electrodialysis, *Electrochemistry, Ion Exchange Membranes, Permselective Membranes, Ion transport, Scale prevention, Scale deposition.
Identifiers: Membrane fouling, Membrane scaling.

The main objectives of the experiments described were the detailed observation of the fouling of anionselective membranes by colloids, the understanding of the mechanism of this phenomenon and, if possible, its elimination or alleviation. The fouling characteristics of various existing membranes as well as synthesized new ones were determined in an effort to find membranes that would be less prone to fouling. Bimolecular leaflet membranes were examined to give a better understanding of the phenomena occurring on the surface of membranes. (Kindley-Office of Saline Water)
W71-03522

POND LININGS FOR DESALTING PLANT EFFLUENTS.
Bureau of Reclamation, Denver, Colo. Div. of Research.
For primary bibliographic entry see Field 05G.
W71-03523

EVALUATION OF PYRRONES AS MEMBRANES,
Franklin Inst. Research Labs., Philadelphia, Pa.
For primary bibliographic entry see Field 05D.
W71-03780

3B. Water Yield Improvement

ON ICE NUCLEATING PROPERTIES OF DIFFERENT FACES OF SILVER IODIDE CRYSTALS,
Nagoya Univ. (Japan). Water Research Lab.
K. Isono, and Y. Ishizaka.
Journal de Recherches Atmospheriques, Vol 3, p 139-140, 1968. 2 p, 1 fig, 1 ref.

Descriptors: *Chemistry of precipitation, *Cloud seeding, *Crystallography, *Nucleation, *Silver iodide, Ice, Supercooling, Freezing, Condensation, Crystal growth, Crystals.
Identifiers: Supercooled clouds.

To clarify the mechanism of ice nucleation, experiments were conducted on ice nucleation on silver iodide films and particles. Specimens of silver iodide films to be used were examined with an electron microscope to determine crystal structures before experiments. Each sample of silver iodide film was mounted on a copper rod cooled with a Peltier element. Temperature and dew point on the surface of the samples were controlled. Below -8 deg C and below water saturation, ice crystals were nucleated on prism faces of AgI, whereas above water saturation ice crystals were nucleated from supercooled water droplets on both basal and prism faces, preferentially on the basal. The silver iodide films were deposited on the basal plane of muscovite crystals with special care that most films

were so orientated that their basal faces were parallel to the basal faces of muscovite. (Knapp-USGS)
W71-03430

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
Army Electronics Command, Fort Huachuca, Ariz. Atmospheric Science Lab.
Jon F. Bartholic, Jack R. Runkles, and Ernest B. Stenmark.
Water Resources Research, Vol 3, No 1, p 173-179, First quarter 1967. 3 fig, 1 tab, 12 ref.

Descriptors: *Water temperature, *Evaporation control, *Monomolecular films, *Reservoir evaporation, Water conservation, *Temperature, Water balance, Energy budget, Mass transfer.

Since a considerable portion of the available supply of water is stored in reservoirs, emphasis has been placed on preserving this water for future use. It is the purpose of this paper to evaluate the effectiveness of a monolayer in retarding evaporation from the surface of a reservoir by means of three approaches, such as: the water-budget method, the energy-budget, mass-transfer method and the U. S. Bureau of Reclamation simplified method (U. S. B. R.). The application of a monolayer to a reservoir water surface to reduce evaporation showed a relative rise in the water temperature not only at the surface, but also at greater depths. It is stated that this increase in temperature must be accounted for in predicting the reduction in evaporation by monolayers. Neglecting this change in temperature, the corresponding change in vapor pressure and using only the temperature actually measured after film application, results in evaporation reduction estimates by the U. S. B. R. simplified method, which estimates are found to be 8 to 14% too large. (Herrera-Vanderbilt)
W71-03473

POSSIBLE EFFECTS OF PRECIPITATION MODIFICATION ON STREAM CHANNEL GEOMETRY AND SEDIMENT YIELD,
Pennsylvania State Univ., University Park.
Albert Rango.
Water Resources Research, Vol 6, No 6, p 1765-1770, December 1970. 6 p, 1 fig, 3 tab, 11 ref. Bur of Reclamation Contract 14-06-D-6467.

Descriptors: *Weather modification, *Rainfall-runoff relationships, *Channel morphology, *Sediment yield, Sediment transport, Bed load, Scour, Stream erosion, Suspended load, Data collections, Hydrologic data, Regression analysis, Simulation analysis, Mathematical models, Sampling, Discharge (Water).
Identifiers: *Channel geometry.

Stream channel geometry data were collected on 18 small watersheds in the West and sediment yield data were obtained for 673 small watersheds across the United States. Regression analysis was used to test what effects precipitation modification might have on these watershed parameters. No consistent changes of stream channel geometry between watershed areas were obtained, but the results indicated that the stream channel at a given location would adjust significantly in response to increases in precipitation (amounting to 14% annually). This response would probably initiate increased stream channel erosion. Sediment yield will increase substantially in semiarid regions with increasing precipitation until about 27 inches mean annual precipitation; at this point vegetation growth as a result of increased precipitation will begin to reduce sediment yield. Significant changes in stream channel geometry and sediment yield may result in sufficient economic damage to nullify many of the beneficial effects of weather modification. (Knapp-USGS)
W71-03693

SOME GENERAL COMMENTS ON THE SYNERGISTIC RUNOFF EFFECT FROM JOINT WATERSHED MANAGEMENT AND WEATHER MODIFICATION,
State Univ. of New York, Syracuse. Water Resources Center.
For primary bibliographic entry see Field 02A.
W71-03696

3C. Use of Water of Impaired Quality

SIGNIFICANCE OF SILICA IN THE LOSS OF MAGNESIUM FROM IRRIGATION WATERS,
California Univ., Riverside.
For primary bibliographic entry see Field 02K.
W71-03494

3D. Conservation in Domestic and Municipal Use

DETERMINATION OF THE SIGNIFICANCE OF VARIABLES AFFECTING RESIDENTIAL WATER CONSUMPTION,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 06D.
W71-03517

WATER AND CITIES AND INDUSTRIES,
Hazen and Sawyer, New York.
For primary bibliographic entry see Field 06D.
W71-03595

3E. Conservation in Industry

WATER AND CITIES AND INDUSTRIES,
Hazen and Sawyer, New York.
For primary bibliographic entry see Field 06D.
W71-03595

3F. Conservation in Agriculture

CHANGING AGRICULTURAL PRACTICE IN AN ARABIAN OASIS; A CASE STUDY OF THE AL'AIN OASIS, ABU DHABI,
Durham Univ. (England). Dept. of Geography.
J. H. Stevens.
Geographical Journal, Vol 136, No 3, p 410-418, September 1970. 3 fig, 10 ref.

Descriptors: *Irrigation practices, *Arid lands, *Regional analysis, *Social impact, *Economic impact, Cultivated lands, Crop production, Forages, Dates, Trees, Economic efficiency, Climatic data, Hydrologic data, Soil types, History, Social adjustment, Area redevelopment, Social change, Agriculture, Seasonal, Resource development, Irrigation water, Vegetable crops, Diversification.
Identifiers: *Trucial states, *Abu Dhabi, *Oases, *Underdeveloped lands, *Agricultural evolution, Africa, Oasis agriculture.

Abu Dhabi is one of the 7 Trucial states and has a large national income from oil. Major development projects have concentrated on communications, industry and municipalities. However, due to an increasing population and greater national wealth, the agricultural sector has increased in size and has become more diversified and more commercially oriented. Most of the agriculture is concentrated around a few small strings of oases and expansion has been through the drilling of irrigation wells in these areas. The traditional small data gardens (less than 1 ha) have been surrounded by many small holdings (20-25 dunnums) and several large units (15-100 ha). This has been accompanied by crop diversification into income-yielding vegetables and forages (mainly lucerne). The rather swift agricultural changes have been accompanied by some social consequences - seasonal market gluts of vegetables, inefficiencies due to ignorance of modern agricultural techniques and increa spread of human and plant disease vectors du increased irrigation. Nevertheless it appears the transition from the traditional economy is gely successful. (Casey-Arizona)
W71-03333

WILDLIFE V SHEEP AND CATTLE AFRICA,
Leslie Brown.
Oryx, Vol 10, No 2, p 92-101, September 196 fig.

Descriptors: *Grazing, *Wildlife, *Dome animals, *Rainfall, *Grasslands, Habitats, Agri ture, Humid climates, Semiarid climates, Arid mates, Food abundance, Food chains, Food ha Animal behavior, Population, Ecology, Econo efficiency, Damages, Economic feasibi Economic justification, Environmental effe Erosion, Social impact, Animal diseases, Ani populations, Wildlife management, Disea Range management, Forests, Productiv Biomass, Proteins, Sheep, Cattle.
Identifiers: *Africa, *Pastoral cultures, *Noma cultures, *Wildlife harvesting, Tsetse flies.

A modern paradox is that while man, at leas Africa, systematically eliminates native wildlif the process of agricultural development, hardly natural areas have been destroyed by wildlife. tually every area inhabited by man and domestic animals has been methodically and s ously damaged. Three types of African grassla are distinguished on the basis of rainfall. Agri tural activities in each area must vary becaus differing productivities. Highest rainfall areas 40 ins/yr) are also the highest agricultural pro tivity areas and elimination of most wildlif probably justified. However, inefficient cultiva and soil conservation practices in these areas to the shifts in human population to lower rai areas and consequent destruction of vital wil habitats. It is argued that crucial economic fac are ignored in exploitation of low-rainfall ar Because of adaptation to a wider variety of pla more efficient water conservation mechani greater disease resistance and adaptive popula restriction mechanisms, which avert overgra wild animals may be more economical po producers than domestic animals. Nomadic p tices in arid regions, systematic wildlife harves elimination of expensive tsetse fly eradication grams and more realistic economic evaluation suggested. (Casey-Arizona)
W71-03341

CLIMATE, PESTS AND AGRICULTURE,
Gatooma Research Station (Rhodesia).
F. E. M. Gillham.
Agroclimatological Methods; Proceedings of Reading Symposium, Natural Resources Resea Vol 7, p 131-139, UNESCO, 1968. 35 ref.

Descriptors: *Insects, *Crop response, *Ecolo distribution, *Insect control, *Environmenta fects, Winds, Temperature, Rainfall, Agron Food habits, Food webs, Agriculture, In behavior, Insecticides, Biocontrol, Chemcon Insect attractants, Ecosystems, Insect resista Cotton, Pest control, Population, Climatol Microenvironment, Microclimatology, Irriga effects, Predation, Economic feasibility, Life h ry studies, Ecology, Dispersion, Physiolo ecology.
Identifiers: *Agroclimatology, *Bioclimatol Adaptation.

Insect specialization has been evolving for at 250 million years and has been characterize adaptive responses to competition resultin evolution from polyphagous to oligophagous t very specialized monophagous feeding habits. rise of agriculture with its intensive one-crop centration has provided optimal environmen highly specialized insects in which the no population regulatory mechanism of food li

as been removed. Emphasis is placed on the nic relationship between the insect predator s plant host so that control studies must in- a thorough knowledge of the biology of both. erature, rainfall and wind are critical climatic s affecting insect populations, and these in- with the unique biology of a given crop plant rrounding edaphic conditions. Additionally, climatology may differ greatly from macrocli- ogy and should be taken into consideration in udy of crop ecosystems. Agronomic factors as irrigation will create changes in local stems which must be thoroughly assessed in of potential effects on pest populations. Vari- ethods of insect control are outlined and it is d that they should not cancel out each other eed economic feasibility. (Casey-Arizona)
03347

THER AND PLANT DISEASE FORECAST-

er Bureau, Tifton, Ga. Agricultural Service

alli.
limatological Methods; Proceedings of the ng Symposium, Natural Resources Research, p 341-346, UNESCO, 1968. 2 tab, 18 ref.

ptors: *Plant diseases, *Weather, *Forecast- *Plant pathology, Temperature, Rainfall, , Humidity, Seasonal, Light, Potatoes, s, Apples, Scabs, Pecans, Tobacco, Molds, , Mildews, Peanuts, Environmental effects, on, Pathogenic fungi.
fiers: *Agroclimatology, *Bioclimatology.

f the most elementary and generally valid ples of plant pathology is that bioclimate ner and soil conditions) influences seasonal opment and geographic distribution of plant es. The 3 most influential components of the mate are wind, relative humidity, and tem- re. Severity of an outbreak of disease is a on of bioclimate, susceptible plant vulnera- and pathogen virulence. Examples are given cific diseases, their meteorological criteria, ds of forecasting their occurrences or spread, tual advisories issued. (Casey-Arizona)
03348

MATE DISPOSAL OF PHOSPHATE FROM E WATER BY RECOVERY AS FERTIL-

(W. R.) and Co., Clarksville, Md.
imary bibliographic entry see Field 05D.
03459

FICIAL USES OF THERMAL WATER,
Corp. of America, Portland, Oreg. Portland tion.
imary bibliographic entry see Field 05C.
03471

JDY OF EVAPORATION SUPPRESSANTS R GREENHOUSE CONDITIONS: UATIONS I TO IV,
Agricultural Experiment Station, College n.
imary bibliographic entry see Field 02D.
03485

RROW WATERSHEDS,
Agricultural Experiment Station, College n.
Mulkey, Jr.
A and M University, Texas Agricultural Ex- ent Station, Progress Report 2619, 1968, p 7- ig, 2 tab.

iptors: *Agricultural watersheds, *Planting gement, *Water utilization, *Cotton, *Crop ction, Water conservation, Water manage- (Applied), Texas, Rainfall, Soil moisture, ation, Soil-water-plant relationships, Arid lands, Small watersheds, Dry farming, Fallowing, Fibers (Plant), Spatial distribution, Moisture availability, Data collections, Surface runoff.
Identifiers: *Interrow watersheds, *Skip-row planting, *Fallow rows, Texas Rolling Plains, Semiarid lands.

Establishing interrow watersheds in skip-row planted cotton was investigated at Chillicothe, Texas, from 1965 to 1967. Cotton lint yields increased 151 pounds per acre in normal rainfall years when planted in two fallow rows, in a two in-two out skip row pattern. The rows were ridged and covered with a plastic fabric, forming an interrow watershed. Interrow watersheds increased available soil moisture in the Texas Rolling Plains. Available water is the most limiting factor for producing cotton fiber in arid and semiarid lands. Figures show dryland cotton under conventional and interrow watershed cultivation. Tables include rainfall and lint yield data. (Popkin-Arizona)
W71-03486

THREE METHODS OF WATER CONSERVATION FOR DRYLAND COTTON PRODUCTION,
Texas Agricultural Experiment Station, College Station.
P. T. Marion.
Texas A and M University, Texas Agricultural Experiment Station, Progress Report 2620, 1968, p 10-12. 3 fig, 1 tab, 3 ref.

Descriptors: *Cotton, *Land forming, *Water conservation, *Crop production, *Dry farming, Land management, Contour farming, Slopes, Soil-water-plant relationships, Texas, Terracing, Soil moisture, Soil water, Runoff, Water utilization, Bench leveling, Contour furrows, Depth, Moisture availability, Agricultural watersheds, Water management (Applied).
Identifiers: *Cotton lint, *Row spacing, Border spacing, Semiarid lands.

The Texas A. and M. University Research Station at Spur has used several water conservation methods since 1927. Closed-end contour terraces, which hold all the water that falls on the land, were compared with contoured rows and sloping rows. Contour terracing increased available moisture and lint cotton yield. Land leveling between terraces increased crop production. Runoff water utilization of leveled terraces effected the greatest crop production increase. Bench leveling using parallel borders (8 to 16 rows apart) produced a uniform crop without increasing available soil moisture or cotton lint yield. Close border spacing was a disadvantage. A new parallel terrace system was constructed with terraces spaced 64 rows apart on leveled land. The crop was more uniform and field work was facilitated, although there was no increase in crop production. Figures show effect of depth of soil moisture at planting time, uniform water spread and crop production over a leveled terrace. A table compares parallel leveled terracing, contour non-leveled terracing and contributing level watershed in terms of total acreage, planting pattern and lint yields. (Popkin-Arizona)
W71-03487

STRAW MANAGEMENT-NITROGEN TREATMENT INVESTIGATIONS IN THE CONTINUOUS PRODUCTION OF IRRIGATED WINTER WHEAT,
Southwestern Great Plains Research Center, Bushland, Tex.
John Shipley, J. S. Wehrly, and Cecil Regier.
Texas A and M University, Texas Agricultural Experiment Station, Progress Report 2706, October 1969. 17 p, 1 fig, 7 tab, 6 ref.

Descriptors: *Crop production, *Wheat, *Nitrogen, *Soil-water-plant relationships, *On-site investigations, Burning, Fertilization, Texas, Sampling, Treatment, Irrigation water, Infiltration, Organic matter, Weight, Proteins, Soil analysis, Economic feasibility, Crop response, Farm management, Soil aggregates, Data collections.
Identifiers: *Straw management, *Irrigated crops, *Soil working, *Mechanical removal, Replications, Semiarid lands, Plots.

A 15-year study began at Etter, Texas, in 1964 to test long-range effects of removing straw from land cropped continuously to irrigated winter wheat. Results from 1965 to 1969 are discussed. Three straw management treatments and 2 replications were applied, including straw working into soil, mechanical removal (simulated bailing) and burning. Treatment plots contained 12 subplots, where 6 nitrogen rates were replicated twice and randomized. Worked-in, removal and burning treatments produced 41.6, 44.5 and 46.8 bushels per acre. Yields from burning and removal treatments were significantly higher than incorporation treatments. Yields did not respond to nitrogen fertilizer, though effects of airborne waste products from a nearby ammonium nitrate plant were probable. Figures and tables show wheat straw yield, treatment, infiltration rate, protein analysis, and soil sample analysis. (Popkin-Arizona)
W71-03488

THE EFFECT OF ROW SPACING AND PLANT POPULATION ON IRRIGATED CORN PRODUCTION,
Texas Agricultural Experiment Station, College Station.
K. B. Porter, G. W. Grogan, G. L. Peterson, and W. W. Watson.
Texas A and M University, Texas Agricultural Experiment Station, Progress Report 2724, February 1969, p 22-29. 3 tab.

Descriptors: *Plant populations, *Corn (Field), *Crop production, *Grains (Crops), *Spatial distribution, Forages, Texas, Irrigation efficiency, Weight, Water conservation, Sampling.
Identifiers: *Row spacing, *Irrigated crops, *DeKalb XL 45, *Texas 40, *Ear weight, Plots, Semiarid lands, Texas High Plains.

Optimum row spacings and plant populations for growing irrigated corn on the Texas High Plains were investigated. DeKalb XL 45 averaged 98.6 bushels per acre, regardless of plant population factors of 18, 24 and 30 thousand plants per acre. Texas 40 averaged 80.4 for 18, 57.9 for 24, and 51.8 bushels per acre for 30 thousand plant populations. Row spacings did not greatly affect grain yield. Texas 40 forage production was not affected by row spacing or plant population, though 40-inch spacing produced greater ear weight than did narrower spacings. Greater forage ear weights were produced from 18 thousand plant populations than higher populations. Tables show row spacing and plant population effects on grain yield and forage production for irrigated corn in the 1969 tests at Bushland, Texas. (Popkin-Arizona)
W71-03489

CORN IRRIGATION FIELD STUDY IN MULESHOE AREA, 1969,
Texas Agricultural Experiment Station, College Station.
Leon New.
Texas A and M University, Texas Agricultural Experiment Station, Progress Report 2725, February 1969. 4 fig, 1 tab.

Descriptors: *Corn (Field), *Irrigation practices, *Irrigation efficiency, *Crop production, *Water management (Applied), Moisture stress, Growth stages, Consumptive use, Soil-water-plant relationships, Texas, On-site investigations, Timing, Rates of application, Leaves, Frequency, Variability, Sampling, Analytical techniques, Soil moisture, Spatial distribution, Depth, Data collections, Rainfall, Water requirements.
Identifiers: *Row irrigation, *Growing season, Mixed soils, Texas High Plains, Semiarid lands.

Corn irrigation was investigated in 9 fields in the Muleshoe, Texas, area during the 1969 growing season to determine irrigation management in-

fluence. Number, amounts and timing of irrigation were evaluated to find important management guides for High Plains growers seeking to improve irrigation efficiency in corn production. Three irrigations applied between the 10 leaf growth and the milk stage of kernel development produced the highest yields. Water application allowed only limited to zero moisture stress during growth stages. Highest average yield was 1,835 pounds per irrigation with 4 irrigations. The number of irrigations varied from 4 to 7 and yields from 6,800 to 8,700 lbs./acre. Alternate row irrigation can be used in mixed soils to speed up water application frequency. The timing of irrigation is more important than the amount of water. Tables and figures show number and amount of irrigation and yield and effects of timing, number and depth of irrigation. (Popkin-Arizona)
W71-03490

AN IRRIGATION TREATMENT-YIELD STUDY WITH CORN GROWN ON THE TEXAS HIGH PLAINS,
Texas Agricultural Experiment Station, College Station.
O. C. Wilke, and R. R. Allen.
Texas Agricultural Experiment Station, Texas A and M University, Progress Report 2726, February 1970. 9 p, 2 tab, 2 fig, 1 ref.

Descriptors: *Corn (Field), *Irrigation effects, *Crop production, *Moisture stress, *Soil-water-plant relationships, Growth stages, Irrigation efficiency, Moisture tension, Irrigation practices, Crop response, Plant growth, Soil moisture, Moisture availability, Tensiometers, Texas, Arid lands, Data collections, Treatment, Clay loam, Plant populations, Leaves, Moisture content.
Identifiers: *Maximum yields, Texas High Plains.

Corn (DeKalb XL45) planted in 30-inch rows in Pullman clay loam at Bushland, Texas, was subjected to 9 different irrigation treatments based on stage of plant development. Plant populations and moisture regimens were not optimum for maximum yields. Moisture stress during the silking and pollination period was most injurious to yields. Visual symptoms of stress--crinkling of leaf edges and dying of lower leaves--were apparent in some instances when the soil water content in the top 4 feet of soil was 28 to 30 percent by volume. Soil moisture tensiometers operated satisfactorily in the Pullman clay loam at soil moisture tensions less than 70 centibars. To obtain maximum yields of corn, the soil moisture tension at the 12-inch depth should be less than 70 centibars. Data was not sufficient to verify Taylor's root-zone soil moisture tension of 50 centibars for maximum corn production. Tables and figures show corn irrigation treatments and yields; effect on stage of plant development of yield response and irrigation efficiency; stress days versus corn yield and changes in soil moisture tensions on dryland and irrigated corn with time. (Popkin-Arizona)
W71-03492

CORN DATE-OF-PLANTING AND IRRIGATION TIMING STUDY,
Texas Agricultural Experiment Station, College Station.
John Shipley, and Cecil Regier.
Texas Agricultural Experiment Station, Texas A and M University, Progress Report 2727, February 1970. 7 p, 4 tab, 2 ref.

Descriptors: *Corn (Field), *Timing, *Growth stages, *Irrigation effects, *Crop response, Soil-water-plant relationships, Irrigation practices, Crop production, Plant growth, Moisture stress, Smuts, Texas, Mature growth stage, Irrigation water, Rates of application, Water requirements, Water utilization, Data collections, Planting management, Consumptive use, Flexibility, Varieties, Scheduling.
Identifiers: *Texas High Plains, Limited irrigation, Hybrids.

Three hybrid corn varieties (DeKalb XL 45, Agrow 204, Texas 40), each representing a different maturity group, were evaluated under 3 different irrigation timing schedules based on growth stage on 4 separate planting dates (1 April, 15 April, 1 May, 19 May). The relatively low yields can be explained partly by moderate to severe moisture stress experienced by all groups during the silking-pollination period and by the smut in some varietal subplots. Although this report covers only one year's results, the data indicate that irrigated corn can be produced over a wide range of planting dates in the High Plains. This range permits corn and grain sorghum to be compatible under limited irrigation water conditions. If the 5 post-plant irrigations scheduled in this study are assumed to be accurate, results justify application of irrigation water when the variety reaches the growth stage specified. Tables present yields of several hybrids under various irrigation timing schedules, general agronomic data, number of days to reach specified growth stages and stages of growth versus period of high consumptive water use. (Popkin-Arizona)
W71-03493

EFFECTS OF PETROLEUM MULCH ON SOIL WATER CONTENT AND SOIL TEMPERATURE,
Oregon State Univ., Corwallis. Dept. of Soils.
For primary bibliographic entry see Field 02G.
W71-03725

OPERATIONS AND MAINTENANCE COSTS OF IRRIGATION DISTRIBUTION SYSTEMS,
Idaho Univ., Kimberly. Twin Falls Branch Experiment Station.
For primary bibliographic entry see Field 06C.
W71-03779

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).
For primary bibliographic entry see Field 06E.
W71-03791

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MANIPULATION OF RESERVOIR WATERS FOR IMPROVED QUALITY AND FISH POPULATION RESPONSE,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 05G.
W71-03307

A STATISTICAL MODEL TO PREDICT THE TRANSIT CAPACITY OF SEAL-LEVEL CANALS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-03319

SEEPAGE IN MISSISSIPPI RIVER BANKS; REPORT 1, ANALYSIS OF TRANSIENT SEEPAGE USING VISCOUS FLOW MODEL AND NUMERICAL METHODS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
C. S. Desai.
Sponsored by U. S. Army Engineer Division, Lower Mississippi Valley. U. S. Army Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper S-70-3, February 1970. 54 p, 2 app, 18 fig, 21 ref.

Descriptors: *Seepage, *Mississippi River, *Ba stability, *Numerical analysis, Viscous fl *Model studies, Slope stability.
Identifiers: *Finite element method.

Design of stable riverbank slopes along Mississi River is dependent upon seepage conditions wit the banks. Because available seepage analyses not adequate for determining changing free-wa surface, a parallel plate viscous flow model constructed, tested, and found to be a relia means of obtaining the transient free surface wit a sloping bank. Two series of model tests were p formed using a vertical upstream face and an stream slope of 45 deg. Because experime results are suitable only for simple boundary co tions and for homogeneous banks, some analyt techniques were developed for use with more co plex conditions. The finite difference and the fi element methods provide efficient numer techniques for obtaining numerical soluti There was good agreement between the two w comparing numerical results with those obtai from experiments with the model. Basic form tion of the finite element method was develo and is included in this report. (Spivey-WES)
W71-03320

NAVIGATION PROBLEMS AT CH COTEAGUE INLET, VIRGINIA.
Corps of Engineers, Washington, D.C. Commit on Tidal Hydraulics.

Printed at U.S. Army Engineer Waterways Exp ment Station, Vicksburg, Mississippi, Septem 1970. 13 p, 3 pl.

Descriptors: *Shoals, Channel improvem *Navigation conditions, Dredging, Inlets (Wa ways), Virginia.
Identifiers: *Chincoteague Inlet, Va.

Navigation problems created by littoral drift shoaling at Chincoteague Inlet were brought bef the Committee on Tidal Hydraulics. Basic quest was whether provision of a channel 12 ft deep 300 ft wide for fishing boats and pleasure craft economical and physically feasible. It was c cluded that a satisfactory channel would be ficult and expensive to construct and maintain. ternates to the plan are presented. It was recommended that experimental dredging be d prior to project formulation. (Spivey-WES)
W71-03321

ROGUE RIVER, OREGON.
Corps of Engineers, Washington, D.C. Commit on Tidal Hydraulics.

Printed by U. S. Army Engineer Waterways Exp ment Station, Vicksburg, Mississippi, March 19 18 p, 1 photo.

Descriptors: *Shoals, Channel improvem Navigation conditions, Dredging, Oregon.
Identifiers: *Rogue River, Ore.

Division Engineer, U.S. Army Engineer Divis North Pacific, requested that Committee on T Hydraulics consider the difficulty of maintain proper navigation dimensions in Rogue River addition to shoaling, there is a problem of ope ing a dredge due to weather and sea conditi This report presents the pertinent facts bearing the problems and an analysis along with con sions and recommendations. (Spivey-WES)
W71-03322

THE QUASI-PERMANENT REGIME RIVERS AND THE PREDICTION OF FLOOD
Army Engineer Waterways Experiment Stat Vicksburg, Miss.
G. H. Keulegan, and G. W. Patterson.
Sponsored by the National Bureau of Standa U.S. Army Engineer Waterways Experiment S tion, Vicksburg, Mississippi, Miscellaneous Pa H-69-9, September 1969. 81 p, 14 fig, 34 ref.

criptors: *River flow, *River forecasting, rs, *Flood forecasting, *Discharge measure- t.
tifiers: *Maillet transformation, *Bachet ograph.

paper summarizes the early basic knowledge e quasi-permanent regime of rivers and flood ng. Numerous applications are presented as nples of working methods. (Keulegan-WES) -03327

IGN OF OVERFLOW ROCKFILL DAMS,
nische Hochschule, Munich (West Germany).
primary bibliographic entry see Field 08D.
-03349

ANSAS POWER AND LIGHT CO V ORR BILITY FOR FLOOD DAMAGE CAUSED NEGLIGENT FLOOD GATE OPERATION).
primary bibliographic entry see Field 06E.
-03352

ISVILLE AND N RR V VANDIVER (DIVER- N OF RIVER CAUSED BY OBSTRUCTION).
primary bibliographic entry see Field 06E.
-03353

NDATION PRECOMPRESSION WITH TICLE SAND DRAINS,
y Engineer Waterways Experiment Station, sburg, Miss.
primary bibliographic entry see Field 08D.
-03356

CEEDINGS MISSISSIPPI WATER OURCES CONFERENCE, 1970.
issippi State Univ., State College. Water urces Research Inst.

ilable from NTIS as PB-196 731, $3.00 in er copy, $0.95 in microfiche. Proceedings er Resources Conference, Mississippi State versity, State College, April 14-15, 1970, ished by Mississippi State Univ Water urces Research Institute, 1970. 191 p. OWRR ect A-999-MISS (6).

criptors: *Conferences, *Water resources, ssissippi, *Water resources research act, Trans- ation, Port authorities, Hurricanes, Mapping, ds, Flood damage, Sedimentation, Flood con- Flood plain insurance, Irrigation water, Scour, nnel morphology, Inter-basin transfers, reation, Tracers, Water analysis, Water pollu- Bioindicators.

fifth Mississippi Water Resources Conference held in Jackson on 14-15 April for the purpose exchanging information pertaining to water urces. The topics discussed include seaport and sportation development, hurricane damage ping, hurricane frequency, flood insurance, d control, alluvial channel morphology, scour, er importation for irrigating the Texas High ns, recreation, mapping, tracer studies, water ysis, and water pollution indicator organisms. also W71-03381 thru W71-03388) (Knapp- GS)
-03380

E ROLE OF TVA RESERVOIRS IN REDUC- FLOOD CRESTS ON THE LOWER OHIO D MISSISSIPPI RIVERS,
nessee Valley Authority, Knoxville. Procedures elopment Section.
sell L. Tucker.
Proceedings Water Resources Conference, Mis- ppi State University, State College, April 14- 1970, published by Mississippi State Univ ter Resources Research Institute, p 47-73, 0. 27 p, 10 plate, 1 tab, 8 ref. OWRR Project A- -MISS (6).

Descriptors: *Flood control, *Reservoir operation, *Tennessee Valley Authority Project, River forecasting, Flood damage, Economics, Tennessee River, Water management (Applied), Ohio River, Mississippi River.

TVA reservoirs have a significant role in reducing flood crests on the lower Ohio and Mississippi Rivers. They have effected crest reductions of over 3 feet. Direct flood damages already prevented total over $43,000,000, and additional protection is afforded to 6 million acres of productive land protected by downstream levees. Meeting demands for increased effectiveness in flood control requires improved meteorological forecasts and the development of even more effective operating procedures. (See also W71-03380). (Knapp-USGS)
W71-03382

CROSS-SPECTRUM ANALYSIS OF GROUND-WATER LEVELS IN AN ESKER,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 02F.
W71-03394

ORTHONORMAL FUNCTION TABLES AND THE SEEPAGE OF STEADY RAIN THROUGH SOIL BEDDING,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 02G.
W71-03441

EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE THEORY,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03442

PRELIMINARY REVIEW AND ANALYSIS OF FLOOD CONTROL PROJECT EVALUATION PROCEDURES,
INTASA, Menlo Park, Calif.
For primary bibliographic entry see Field 06F.
W71-03531

PARAMETERIZATION OF OBSERVED HYDROGRAPHS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03665

FLOOD REGULATION BY COLUMBIA TREATY PROJECTS,
Corps. of Engineers, Portland, Oreg. Water Control Branch.
Mark L. Nelson, and David M. Rockwood.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY1, Paper 7798, p 143-161, January 1971. 19 p, 12 fig, 1 tab, 9 ref.

Descriptors: *Flood control, *Historic flood, *Columbia River, *Treaties, *International Joint Commission, Peak discharge, Dams, Reservoirs, Regulation, Routing, Flood routing, Streamflow forecasting, Water management (Applied), Reservoir operation, Systems analysis.
Identifiers: *Columbia River Treaty.

Reservoir regulation by Columbia Treaty Projects, in conjunction with existing U. S. Columbia Treaty Projects, should provide assured control of major floods to reasonably safe levels. A flood control operating plan for the Treaty Projects was developed in accordance with Treaty requirements. This paper describes the flood characteristics of the Columbia River, the principles of flood regulation, and the methods used in developing the flood control operating plan. Results of flood regulation studies for the period 1929-1958, together with the flood of 1894, the maximum flood of historic record, are presented. (Knapp-USGS)
W71-03666

SMALL SAMPLE PROPERTIES OF H AND K--ESTIMATORS OF THE HURST COEFFICIENT h,
Thomas J. Watson Research Center, Yorktown Heights, N. Y.; and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-03674

A STOCHASTIC MODEL FOR FLOOD ANALYSIS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02E.
W71-03680

ESTIMATING EXPECTED VALUES FOR MONOTONE SAMPLES,
Geological Survey, Washington, D.C.; American Univ., Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-03689

SOME EXTENSIONS OF TWO-STREAMS STORAGE MODEL,
Lancaster Univ., Bailrigg (England).
A. A. Anis.
Journal of Hydrology, Vol 11, No 4, p 363-378, November 1970. 16 p, 3 ref.

Descriptors: *Water storage, *Reservoir design, *Streamflow forecasting, Probability, Statistical methods, Mathematical studies, Time series analysis, Markov processes, Stochastic processes, Statistical models.
Identifiers: *Reservoir storage forecasting.

Methods are given for calculating reservoir storage probability when two streams of water meet in a joint path but technical difficulties prohibit building a dam on the joint path. The respective inputs are mutually independent, non-seasonal, and without any serial correlation structure. The reservoir is to be managed in such a way as to maintain a given minimum flow below the confluence. The probability of emptiness of the dam before filling completely may also be obtained. This two-stream model is formally equivalent to a single stream model with unit release and a modified input. (Knapp-USGS)
W71-03699

THE GENETIC METHOD OF COMPUTATION OF FLOOD CAUSED BY STORM RAINFALLS IN SMALL CATCHMENT AREAS IN THE ABSENCE OF HYDROLOGICAL DATA,
Wyzsza Szkola Rolnicza, Wroclaw (Poland).
For primary bibliographic entry see Field 02A.
W71-03716

ESTIMATION OF DESIGN FLOOD DISCHARGES ESPECIALLY FOR RIVER VALLEY PROJECT IN INDIA,
Ministry of Irrigation and Power (India); and Central Water and Power Commission, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03721

A UNIFIED NATIONAL PROGRAM FOR MANAGING FLOOD LOSSES.
Task Force on Federal Flood Control Policy, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-03773

EXECUTIVE ORDER 11296 (EVALUATION OF FLOOD HAZARD IN FEDERAL ACTIVITIES).
For primary bibliographic entry see Field 06E.

W71-03778

STATUS OF PENDING WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).
For primary bibliographic entry see Field 06E.
W71-03790

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).
For primary bibliographic entry see Field 06E.
W71-03791

ILLINOIS LAWS RELATING TO WATERWAYS, 1969.
Illinois State Dept. of Public Works and Buildings, Springfield.
For primary bibliographic entry see Field 06E.
W71-03799

WATER FOR ILLINOIS - A PLAN FOR ACTION.
Illinois State Technical Advisory Committee on Water Resources, Springfield.

Springfield, Ill, March 1967. 452 p, 201 fig, 5 map, 2 illus, 152 photo, 83 tab, 3 chart, 95 ref.

Descriptors: *Water resources development, *Water supply, *Water pollution, *Illinois, State governments, Water resources, Water management (Applied), Water conservation, Water control, Water costs, Water delivery, Water demand, Water policy, Water quality, Water requirements, Water storage, Water treatment, Water utilization, Water loss, Water purification, Watershed management, Federal government, Administrative agencies, Cities, Recreation demand.

This comprehensive study of available Illinois water resources and plans for development defines water resources planning as 'the consideration of alternative uses of the resource to meet future problems and opportunities and to establish priorities for action.' Primary subdivisions of the work are: (1) water resources, (2) water supply and use, (3) pollution and pollution control, (4) land and water management, (5) floods and flood control, (6) navigation, (7) water related recreation, and (8) laws and government. Specific conclusions and recommendations are set forth at the conclusion of each chapter. In the last chapter, the relationships between federal, state, and local government are examined, with special emphasis upon federal assistance for the various projects. The committee concludes that $1 billion is necessary for the program, as follows: water-related recreation--$200 million; pollution control--$350 million; flood control--$100 million; and water management--$350 million. The study is replete with graphs, charts, maps and photographs. (Hart-Florida)
W71-03806

4B. Groundwater Management

DELINEATION OF GROUNDWATER FLOW SYSTEMS IN NEVADA,
Nevada Univ., Reno. Center for Water Resources Research.
Martin D. Mifflin.
Available from NTIS as PB-196 657, $3.00 in paper copy, $0.95 in microfiche. Desert Research Institute Technical Report Series H-W, Publication No 4, Nevada Univ Water Resources Research Center, July 1968. 111 p, 13 fig, 2 plate, 2 tab, 206 ref, append. OWRR Project A-009-NEV (1), A-001-NEV (1), and B-006-NEV (1).

Descriptors: *Groundwater movement, *Nevada, *Aquifers, *Groundwater basins, Transmissivity, Recharge, Discharge (Water), Water sources, Water yield, Phreatophytes, Surface-groundwater relationships, Model studies, Flow nets, Potential flow, Hydrogeology, Water chemistry, Water temperature, Hydrologic data, Data collections.
Identifiers: Groundwater flow systems (Nev).

Available hydrologic and geologic information was studied using flow system theory in an attempt to delineate groundwater flow systems in Nevada with definition of sink areas, source areas and configuration of flow within the flow system as the primary objective. Source areas and configuration of flow were approximated in most areas. Sink areas have been confidently located for nearly all of the flow systems. Several types of fluid potential measurements are demonstrated to be the optimal methods of delineating groundwater flow systems. Changes in fluid potential in the vertical direction establish source areas, zones of lateral flow, sink areas and boundaries of circulation cells. Groundwater temperature was used to establish apparent depth of circulation. Characteristics of large springs in the carbonate rock province of Nevada, including water chemistry, water temperature, variation in discharge, tritium concentrations and C-14 determinations, have aided flow system delineation. Interbasin flow is closely related to bedrock permeability and availability of moisture for recharge. In nearly every area where interbasin flow has been recognized, there is also relatively permeable bedrock. In most areas of interbasin flow, only limited moisture is available for recharge. (Knapp-USGS)
W71-03302

GROUNDWATER SYMPOSIUM.
For primary bibliographic entry see Field 02F.
W71-03401

GROUNDWATER IN UNCONSOLIDATED SEDIMENTS - RECENT DEVELOPMENTS IN NEW SOUTH WALES,
Water Conservation and Irrigation Commission (Australia).
W. H. Williamson.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 1, p 1-12, April 1970. 12 p, 1 fig, 5 ref.

Descriptors: *Water resources development, *Hydrogeology, *Alluvium, Surface-groundwater relationships, Irrigation water, Water yield, Reviews, Surveys.
Identifiers: *Australia, *New South Wales.

There has been a marked increase in the development of the groundwater resources of unconsolidated sediments in New South Wales, Australia in recent years. The causative factors, including the discovery of hitherto unknown resources and the trend to large diameter bores, are reviewed. The acreage irrigated with groundwater has expanded rapidly, particularly since about 1964. In 1967-68, about 97,000 acres were irrigated, an increase of about 12% over irrigation in 1966-67. (See also W71-03401) (Knapp-USGS)
W71-03402

SEISMIC REFRACTION AND ELECTRICAL RESISTIVITY: TOOLS IN GROUNDWATER EXPLORATION,
Iowa State Univ., Ames. Dept. of Earth Science.
For primary bibliographic entry see Field 07B.
W71-03439

RELATIONSHIP BETWEEN HORIZONTAL STRAIN NEAR A WELL AND REVERSE WATER LEVEL FLUCTUATION,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-03686

MULTIPLE GRAVITY WELLS UNDER TRANSIENT STATES OF FLOW,
North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 02E.
W71-03687

ROTARIES TO PLAY BIG ROLE IN FUTU ROCK - DRILLING METHODS,
Christensen Diamond Products Co., Salt Lake C Utah.
For primary bibliographic entry see Field 08A.
W71-03830

DRILLING-MUD LUBRICITY,
National Lead Co., Houston, Tex. Baroid Div.
T. C. Mondshine.
Oil and Gas Journal, Vol 68, No 49, p 70- December 7, 1970. 5 tab, 4 ref.

Descriptors: *Drilling fluid, *Drilling, Oil indus Mud.
Identifiers: *Mud lubricity tester, *Lubricity coe cient, Drill string lubrication, Drilling mud ac tives.

Unless the drilling fluid provides adequate lubri tion, considerable friction exists when a drill str is rotated against a borehole or walls of a ca hole. These frictional forces are especially high directional or crooked holes, and may result in cessive torque when the string is rotated, or in cessive drag when the drill string is pulled from hole. Many drilling mud additives are used reduce torque and drag. The overall performan of many of these materials as drilling mud lub cants is doubtful. Laboratory studies were initia to investigate drilling mud lubricity which primar involves the rubbing of drill pipe and bit against borehole during rotation and tripping. A m lubricity tester simulates drill-pipe rotation a load and measures frictional force. The step-b step procedure of testing the lubricity of drilli mud is listed. In order to simulate various con tions of drillpipe speed and load, tests were co ducted at loads of 240, 480, and 720 psi, and at 120, 240, and 360 rpm. The force needed to itiate movement (static) was measured also at the loads. The coefficient of friction was measured each of these conditions using water and a typi drilling mud field sample. The results are given tabular data. (Campbell-NWWA)
W71-03831

FISHING IS MORE ART THAN SCIENCE,
Forest Oil Corp., Midland, Tex.
E. W. Porter.
Oil and Gas Journal, Vol 68, No 38, p 95-96, Se tember 21, 1970. 1 fig.

Descriptors: *Drilling, *Drilling equipment, Oil i dustry.
Identifiers: *Fishing, *Mechanical equipme failure, Down-hole problems, Human error, Coll inspection, Service factor, Aluminum drill pip Sluffing conditions, Excessive torque, Overshot Grapples.

The art of fishing, broadly defined as the attempte recovery of any item from a well which prohibi the continued progress of the desired operation undoubtedly only very little younger than the art drilling. Drilling has progressed to a science, b fishing remains as it started, an art. The causes fishing jobs fall into 3 main categories: mechanic failure of equipment, downhole problems related hole conditions, and human errors. Each cause ca be minimized, but it is important to realize tha economics and time must always be considered The normal practice in safeguarding agains mechanical failure is limited to the inspection drill pipe and collars. The problems in hole cond tion which create fishing jobs relate primarily t unstable formations. These are generally controlle with one or more of the many mud systems availa ble. In evaluation of preventive measures to pro vide hole stability, the time factor must be con sidered. Human error continues to remain a majo factor in causing fishing jobs. The best chance o avoiding a fishing job lies in good job plannin based on the best available data; in the ability to an ticipate problems; and in good communications (Campbell-NWWA)
W71-03832

S TO MILLING, WASHOVER OPERA-NS,
l Oil and Gas Co., Midland, Tex.
rnard Lankford, Jr.
nd Gas Journal, Vol 68, No 38, p 97-104, Sep-er 1970. 5 fig, 1 tab.

riptors: *Drilling, *Drilling equipment, Oil in-y, Drilling fluids.
ifiers: *Fishing, Method of sticking, Washpipe h and size, Rotary shoe, Open-hole washover, over inside casing, Milling.

e are many methods of retrieving 'junk' from ole and each one has its own special applica- In almost all cases, a fishing expert should be cation to supervise the operations. The details e operation which are handled by the fishing rt are not discussed but some of the basic deci- which must be made before fishing is begun is dered. Washover operations are used to ve stuck drill pipe on drill collars, and in some nces casing. Washing over consists of rotating ger pipe over the smaller stuck pipe and ng away the material causing the sticking. ng operations are used when the 'fish' cannot trieved. Milling is described as drilling up the y the oil industry. Before washover operations egun several factors must be considered, i.e., lrilling fluid condition, (2) method and depth icking, (3) washpipe size and length and (4) of rotary shoe. (Campbell-NWWA)
-03833

SIDER LOST CIRCULATION IN WELL NNING, RIG SELECTION,
il Oil Corp., New Orleans, La.
Kerr.
nd Gas Journal, Vol 68, No 38, p 92-94, Sep-er 1970. 2 fig.

riptors: *Drilling, *Rotary drilling, Drilling pment, Oil industry.
tifiers: *Lost circulation, *Rig selection, *Well ning, Formation pore pressures, Fracture ients, Mud loss, Lost circulation recognition.

circulation continues to be a serious drilling lem. Sufficient occurrences can double the of an oil well. Improved drilling technology has a significant impact on the problem. The ability lculate formation pore pressures and fracture ients has done much to reduce the frequency st circulation problems. Using the minimum weight required to control the formation pore sure will not only speed drilling but will also t in less mud loss. Lost circulation can be clas-d as: (1) seepage loss to highly permeable, mented, shallow sands, gravel or shell beds, or lar limestone, (2) sudden complete loss to rnous formation and (3) partial or complete to natural or induces fractures. This is the most blesome type. (Campbell-NWWA)
-03834

VENTING FILAMENTOUS SCALE IN TER WELLS,
eville Water Works, N.J.
primary bibliographic entry see Field 08G.
-03835

IGN AND RATING OF WELLS AND WELL LDS,
higan State Geological Survey, Lansing. Dept. onservation.
. Miller.
erican Water Works Association Journal, Vol No 4, p 439-449, April 1957.

criptors: *Water works, *Water supply, Water s, Municipal wells, Well spacing, Groundwater. tifiers: Groundwater development, Geological ditions, Flow characteristics, Coefficient of neability, Well losses.

article reviews the technical field design blems of municipal water wells. The purpose of the paper is to promote interest and understanding of sound technical approaches to field design problems of wells. Complex relationships are simplified and cover topics such as the relationship of spheres to pores sizes, coefficient of permeability, and interpreting test data. The presentation is applicable to the general public. (Campbell-NWWA)
W71-03836

PRODUCTION ANALYSIS OF ARTESIAN WELLS,
Purdue Univ., Lafayette, Ind.
A. L. Simon.
American Water Works Association Journal, Vol 52, No 11, p 1438-1446, November 1960.

Descriptors: *Artesian wells, *Water wells, Specific capacity, Groundwater, Darcy's Law, *Head loss, Hydrogen sulphide, Carbon dioxide.
Identifiers: Discharge-drawdown analysis, Hungary, Interconnected aquifers, Juhasz Equation.

Water and energy waste can be eliminated by proper investigation. A conscious appreciation of the following methods of investigation would considerably improve the present waste, (1) discharge-drawdown analysis, (2) interconnecting aquifer hydraulics, (3) determination of characteristics for each aquifer by rheometering, (4) role of thermal dilation and effect of temperature on head, (5) problems of corrosion caused by hydrogen sulphide and carbon dioxide. (Campbell-NWWA)
W71-03837

PERFORMANCE OF ALLOYS AGAINST EROSION - CORROSION ATTACK,
Stainless Foundry and Engineering, Inc., Milwaukee, Wis.
For primary bibliographic entry see Field 08G.
W71-03838

SECOND CORROSION STUDY OF PIPE EXPOSED TO DOMESTIC WATERS,
For primary bibliographic entry see Field 08G.
W71-03839

RELATION BETWEEN AQUIFER PERMEABILITY AND IMPROVEMENT ACHIEVED BY WELL STIMULATION,
Louis Koenig-Research, San Antonio, Tex.
Louis Koenig.
American Water Works Association Journal, Vol 53, No 5, p 652-670, May 1961. 22 ref.

Descriptors: *Water wells, *Water yield improvement, Specific capacity, Coefficient of permeability, Oil industry.
Identifiers: *Permeation factor, Equilibrium radial flow, Fracturing, *Improvement ratio, Poiseuille Law.

The article states that variation in permeability of aquifers has certain bearing on improvement achieved by well stimulation. The relation is defined in numerical terms and suggests that improvement ratios achieved by every type of treatment decrease with increases in permeation factor. Methods are discussed which offer increases in permeability of various types of well stimulation. Some of the techniques used in the petroleum industry can be adapted to the groundwater industry. (Campbell-NWWA)
W71-03840

CLEANING METHODS FOR DEEP WELLS AND PUMPS,
Board of Water and Light, Lansing, Mich.
Claud R. Erickson.
American Water Works Association Journal, Vol 53, No 2, p 155-162, February 1961.

Descriptors: *Water wells, *Municipal wells, Pumps, Pump testing, Well screens, Corrosion.
Identifiers: *Deep well cleaning, *Stimulation, Redevelopment, Inefficient pump operation, Scale deposits, Static water level.

Two factors which are extremely important to the efficient operation of a well are: (1) stimulation, or redevelopment-of the well when it has declined in productivity, and (2) the cleaning and, if necessary, reconditioning of the pump. The article assumes four basic causes of declines in well production: (1) lowering of the static water level, (2) inefficient pump operation caused by worn, corroded, or plugged parts, (3) deposits of scale, corrosion products, and microorganism growths in the well screen area and on the face of the producing formation, and (4) fouling of the well screen area by mud, sand and silt. Reconditioning of the well and pump can aid in recovering lost production if the decline is due to any of the last three causes. (Campbell-NWWA)
W71-03841

DEVELOPMENT OF REVERSE-ROTARY WELLS,
Winter-Weiss Co., Denver, Colo; and Lauman (C.W.), Bethpage, N.Y.
For primary bibliographic entry see Field 08A.
W71-03844

DEVELOPMENT OF WELLS WITH CABLE TOOLS,
Bucyrus-Erie Co., South Milwaukee, Wis.
For primary bibliographic entry see Field 08A.
W71-03845

REVERT CUTS COSTS AND MAKES BETTER WELLS,
Universal Oil Products Co., St. Paul, Minn. Johnson Div.
For primary bibliographic entry see Field 08A.
W71-03846

REVERSE ROTARY WELL CONSTRUCTION,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 08A.
W71-03847

CEMENTING WATER WELLS,
Halliburton Oil Well Cement Co., Houston, Tex.
For primary bibliographic entry see Field 08A.
W71-03848

SURVEY AND ANALYSIS OF WELL STIMULATION PERFORMANCE,
Louis Koenig-Research, San Antonio, Tex.
Louis Koenig.
American Water Works Association Journal, Vol 52, No 3, p 333-350, March 1960.

Descriptors: *Water wells, *Water yield improvement, Oil industry, Recharge.
Identifiers: *Well stimulation, Specific capacity improvement, Water well hydraulics, Oil well hydraulics.

The results of a study of 870 water well stimulation cases in 141 counties of 24 states are discussed. For all types of treatment in all types of formations median ratio indicates 97% improvement over specific capacity immediately before treatment and 20% improvement over original productions of water well. Treatment failures amounted to 11% with success being greater in consolidated formations than in unconsolidated formation. The study is based on the assumption that a close similarity exists between the technology of crude-oil production and the technology of groundwater production. (Campbell-NWWA)
W71-03849

DRILLING POROSITY LOG PROVES ACCURATE,
J. L. Kennedy.

Oil and Gas Journal, Vol 68, No 34, p 53-55, August 24, 1970. 2 fig.

Descriptors: Logging (Recording), Drilling, Porosity, Boreholes, Drill holes, Geologic formations, Radioactive logging.
Identifiers: Drilling data, Drilling costs, Optimum drilling conditions, Computer use, Rock properties, Bit performance, Pore pressure, Gulf Coast formations, Bulk density logging, Pseudodensity.

Continued refinement in the use of drilling data has been a big factor in keeping oil drilling costs within reasonable limits as materials and labor expense continue to climb. One big hurdle was developing the ability to collect this information during drilling, and analyze it thoroughly enough to be of immediate benefit. Drilling data can be gathered on a given bit run and analyzed in time to determine the optimum drilling conditions to be used on the succeeding bit run. The use of computers is the basis for this advancement. It has been concluded that drilling response is related to the shear and compressive strength of rocks, and these properties are used to indicate porosity in several logging techniques. Thus, rock properties used initially for predicting bit performance and drilling optimization are now used for formation evaluation. One of the resultant new logs is the drilling porosity log (DPL). It interprests drilling data that are related to formation properties, providing an early indication of formation type and porosity. (Campbell-NWWA)
W71-03850

4C. Effects on Water of Man's Non-Water Activities

RATES OF WATER INFILTRATION RESULTING FROM APPLICATIONS OF DAIRY MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
P. J. Zwerman, A. B. Drielsma, G. D. Jones, S. D. Klausner, and D. Ellis.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 263-270. 6 tab, 17 ref.

Descriptors: *Farm wastes, *Cattle, *Infiltration, Time, Corn, Alfalfa, Wheat, Rotations, Rainfall simulators, Rates of application, Fertilizers, Surface runoff, Rainfall.
Identifiers: *Dairy cattle, Intensity, Plots, Mass infiltration.

Sixty randomly selected plot locations were subject to infiltration tests with a rainfall simulator. Three successive tests of one half hour each were applied to the same plot. These results represent the effects of fourteen years of past management on seed beds prepared for corn. The rainfall rate was two and one half inches per hour. A two-by-two factorial and a two-by-four factorial experimental design were utilized. The two-by-two comparisons involved six tons of dairy manure plowed down versus no manure on continuous corn for grain at two rates of mineral fertilization. Manure increased infiltration by 27 percent, heavy mineral fertilization without manure on the last run resulted in a 60 percent decrease in infiltration as compared to manure with moderate mineral fertilization. The two-by-four factorial study again involved six tons of manure plowed down versus no manure on four rotations: (1) continuous corn for grain, (2) corn-oats-alfalfa-alfalfa, (3) corn-corn-oats-alfalfa-alfalfa, and (4) wheat-alfalfa-alfalfa-alfalfa-alfalfa. Manure did not significantly increase rates of infiltration. All rates of fertilization were very moderate. Only rotation No. 4 gave a significant 16 percent increase in rate of infiltration. (See also W71-03542) (White-Iowa State)
W71-03554

4D. Watershed Protection

STRATIGRAPHY, SEDIMENTOLOGY, AND MOISTURE CONTENTS IN A SMALL LOESS WATERSHED IN TAMA COUNTY, IOWA,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03440

VEGETATION AND WATERSHED SHAPE,
Cornell Aeronautical Lab., Buffalo, N.Y.
For primary bibliographic entry see Field 02J.
W71-03692

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House). Subcommittee on Conservation and Credit.
For primary bibliographic entry see Field 06E.
W71-03787

STATUS OF PENDING WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).
For primary bibliographic entry see Field 06E.
W71-03790

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).
For primary bibliographic entry see Field 06E.
W71-03791

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

ANALYSIS OF SOLUTIONS FOR SURFACE ACTIVE AGENTS,
Kentucky Water Resources Inst., Lexington. Kentucky Univ, Lexington. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-03305

DEVICE FOR FIELD DETERMINATION OF HEAVY METALS IN NATURAL WATERS,
Illinois Univ., Urbana. Water Resources Center.
Robert E. Van Atta.
Available from NTIS as PB-196 665, $3.00 in paper copy, $0.95 in microfiche. Final Report, Illinois Water Resources Center, Urbana, WRC Research Report No 35, December 1970. 28 p, 6 tab, 15 fig. OWRR Project A-032-Ill (1).

Descriptors: Trace elements, Water analysis, Water chemistry. Electrolytes, Streams, Electrodes, Polarographic analysis, Analytical techniques, *Pollutant identification, *Heavy metals, Instrumentation, Ions, Copper, Chromium.
Identifiers: Cadmium, Lead, Nickel, Zinc.

The objective was the development and testing of a simple, portable, self-contained device suitable for in situ analysis of natural waters for certain trace metals. The trace metals which were of primary interest were copper, lead, cadmium, nickel, chromium and zinc. Two models of the analyzer were built during the course of this experiment. The first model utilized a rotating platinum electrode in sulfosalicylic acid electrolyte. This was abandoned due to the inconsistent quality of high sensitivity results in the field and the interference of the sulfosalicylic acid medium with analysis of lead and iron ions. The second model used a dropping mercury electrode (DME) in the same electrolytic medium. The medium was discarded due to the interference with lead and iron, but the DME was retained with tri-sodium citrate as the medium since this allows analysis of lead, cadmium, zinc and iron. Details of the construction and field operation of the kit are explained in full. Field sampling techniques are also discussed. The operation of the device is relatively simple and the cost of construction of the inital model was less than $400. The design of the instrument allows the possibility of future development and adaptations. At present, however, the determination of metals is limited to only four ions. The use of mercury makes careful disposal of waste materials necessary. The results have not been compared with the results from known different tests with known reliability.
W71-03311

A PRELIMINARY REPORT ON RAPID BIOLOGICAL INFORMATION SYSTEMS FOR WATER POLLUTION CONTROL,
Virginia Polytechnic Inst., Blacksburg, Va.
For primary bibliographic entry see Field 05C.
W71-03367

INTERFERENCE STUDIES IN THE DETERMINATION OF SODIUM, POTASSIUM, CALCIUM, AND MAGNESIUM IN NATURAL WATERS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Agricultural Research Service, Oxford, Miss., Sedimentation Lab.
For primary bibliographic entry see Field 02K.
W71-03386

RELATIONSHIP BETWEEN POLLUTION INDICATOR ORGANISMS AND THE SALINITY OF MISSISSIPPI'S ESTUARINE WATERS,
Gulf Coast Research Lab., Ocean Springs, Miss.
D. W. Cook, and G. W. Childers.
In: Proceedings Water Resources Conference, Mississippi State University, State College, April 14-15, 1970, published by Mississippi State Univ. Water Resources Research Institute, p 181-191, 1970. 11 p, 6 fig, 6 ref. OWRR Project A-999-MISS (6).

Descriptors: *Estuaries, *Mississippi, *Coliforms, *Salinity, Water pollution sources, Bioindicators, Oysters, Wetlands, Commercial fishing, Sport fishing, Water pollution effects.
Identifiers: *Mississippi Sound.

In general, there is an inverse relationship between the median coliform MPN and the median salinity of the waters of the Mississippi Sound and nearby estuaries. There was, however, considerable variation in the individual coliform MPN counts obtained at all stations. The coliform MPN - salinity relationships in the major bay areas of the Sound were found to be different. These differences are attributed to the different natures and locations of the sources of the indicator organisms in the area and to the variations in the deep water channels in the area. (See also W71-03380). (Knapp-USGS)
W71-03387

SEASONAL VARIATION OF THE SOLUTE CONTENT AND THE Sr-87/Sr-86 RATIO OF THE OLENTANGY AND SCIOTO RIVERS AT COLUMBUS, OHIO,
Ohio State Univ., Columbus, Ohio. Dept. of Geology; and Ohio State Univ., Columbus, Ohio. Water Resources Center.
For primary bibliographic entry see Field 02K.
W71-03390

A CONTROLLED DEPTH, VOLUMETRIC BOTTOM SAMPLER,
Herbert W. Jackson.
The Progressive Fish Culturist, Vol 33, No 2, p 113-115, April 1970. 4 fig, 14 plates, 3 ref.

Descriptors: *Sampling, *Benthos, *Estuarine environment, Limnology, Volume, Shallow water, Potamology, Safety, Mechanical equipment

Dredging, Bottom sediments, Marine animals, Aquatic environment, Ecology, Mudflats, *Pollutant identification, *Littoral.
dentifiers: Quantitative sampling, Infauna, Pollution ecology.

Basic plans are presented for a modification of the Petersen dredge principle for use by hand in wadeble waters, freshwater or marine. Extension hanles could be rigged for use from a boat for use in vaters up to ten or twelve feet in depth, similar to yster tongs. Both area and depth sampled can be ontrolled by design, making volumetric sampling easible if desired. Tips of jaws travel at constant epth. Ample vents covered with fine screening ermit escape of water without loss of organisms. losure of side gap when dredge is open eliminates ss of organisms via open ends during closure, also running water. Depth regulator prevents sinking soft bottoms, strong construction permits use in nds and gravels with up to three or four inch ones. Manipulation and power of hand closure educes dry hauls from sticks or pebbles jammed etween jaws. Handles promote safety from broken ass and other sharp objects in polluted areas. hey also permit use in deeper waters than can be onveniently sampled with Surber type hand samer, or sampling in inclement weather such as rough ice. Sample can be taken quickly, dumped to tub, and slurried or handsorted as desired. onstruction of high strength thin steel would duce weight; stainless steel would eliminate corsion.
71-03449

HANGES IN THE BLOOD OF BROOK TROUT ALVELINUS FONTINALIS) AFTER SHORT-ERM AND LONG-TERM EXPOSURE TO OPPER,
ational Water Quality Lab., Duluth, Minn.
r primary bibliographic entry see Field 05C.
71-03450

ULTURE OF LAKE HERRING IN THE ABORATORY,
ational Water Quality Lab., Duluth, Minn.
hn G. Hale.
e Progressive Fish-Culturist, Vol 32, No 4, p 7-221, 1970. 4 tab, 7 ref. FWQA Program 18050 AD 10/70.

escriptors: Life history studies, Fish diets, Bioas- methods, Fish growth, Minnesota, Herrings, isco.
entifiers: Fish Culture, Duluth (Minnesota), regonus artedii.

ke herring, Coregonus artedii, eggs were colted from the field, incubated, hatched, and the vae cultured in the laboratory on two successive ars. Incubation temperatures averaged 4.2C the st year and 3.9C the second. The larvae were sed at 5.2C. A diet of live brine shrimp (autotically dispensed) produced the largest post lar- fish and the lowest mortality during a 30-day l of five diets. Live brine shrimp (automatically pensed), smaller tanks, and daily treatment of vae with malachite green improved survival the ond year of testing. Growth rate in the laborato- appeared to be slower than the calculated wth rate of lake herring collected from Lake Suior in the Duluth area in August during their ond year of life.
71-03451

EVALUATION OF THE INFRA-RED THERMETER AS AN AIRBORNE INDICATOR OF RFACE WATER TEMPERATURES,
partment of Transport, Toronto (Ontario). teorological Branch.
primary bibliographic entry see Field 07B.
1-03466

FATTY ACID CONTENT AS A MEASURE OF THE ODOUR POTENTIAL OF STORED LIQUID POULTRY MANURE,
Guelph Univ. (Ontario). Dept. of Microbiology.
R. G. Bell.
Poultry Science, Vol 49, No 4, p 1126-1129, July 1970. 4 fig, 7 ref. Ontario Dept of Food and Agr No 695-04 Research Council of Canada No A5730.

Descriptors: *Poultry, *Legislation, *Odor, Farm wastes, Liquid wastes, Gas chromatography.
Identifiers: Fatty acid content, Odor potential.

An attempt was made to find a correlation between odour and the concentration of volatile fatty acids in stored liquid poultry manure. Using both gas chromatographic and column partition chromatographic analysis procedures a relationship between the odour and the fatty acid content of stored liquid poultry manure was observed. A total fatty acid content of 0.1% is suggested as a maximum level to be deemed acceptable for new installations and 0.2% as a minimum level for the initiation of prosecution which may be contemplated for existing facilities. (Christenbury-Iowa State)
W71-03535

URINARY CREATININE AS AN INDEX COMPOUND FOR ESTIMATING RATE OF EXCRETION OF STEROIDS IN THE DOMESTIC SOW,
Purdue Univ., Lafayette, Ind.
R. E. Erb, S. A. Tillson, G. D. Hodgen, and E. D. Plotka.
Journal Paper No 3644, Purdue University Agricultural Experiment Station. Journal of Animal Science, Vol 30, No 1, p 79-85, January 1970. 5 tab, 20 ref.

Descriptors: Farm wastes, Urine, Hogs, Livestock, Animal physiology.
Identifiers: *Steroids, *Creatinine, Index compound.

During two experiments urine was collected form 36 yearling sows to estimate rate-of-excretion of creatinine and to evaluate its use as an index compound. Excretion rate averaged 205 mg/hr. and 1.35 mg/hr./kg live weight for Experiment I as compared to 201 mg/hr. and 1.38 mg/hr./kg live weight for Experiment II. Measurement of urine volume for 48-hr. allows estimation of creatinine excretion rate of sows with coefficients of variability of 7-8%. In comparison, the coefficients of variability were 18 and 13%, respectively, for 12-hr. and 24-hr. periods. These experiments show that the ratio, microgram steroid per mg urinary creatinine is an accurate method for expressing rate of excretion of steroids in urine. (Christenbury-Iowa State)
W71-03538

INTRODUCTION,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
H. C. Zindel, and C. J. Flegal.
In: Research Report 117, Farm Science, MSU Agricultural Experiment Station, July 1970, p 4-7.

Descriptors: *Farm wastes, *Poultry, Odor, Water pollution, Air pollution, Soil contamination, Technology, Nitrates, Nitrites, Disease, Insects, Treatment, Disposal, Standards, Land use.
Identifiers: *Environmental quality, *Confinement production, Animal management, Facility design.

The introductory remarks explain that agriculture-related pollution is but one part of a large national problem; so it must be considered together with municipal, industrial, marine and all other types of pollution in developing an integrated plan for improving the quality of our environment. The volume of livestock wastes produced is a function of the degree concentration and the size of individual production units. Animal wastes are of concern in water, air, and soil pollution. Examples of the increasing numbers of livestock and poultry being produced are given. New and improved technology is needed to handle the wastes from these animals. Problems discussed concerning pollution are: disease, odor, soil contamination, and insects. Four areas of emphasis are given that encompass the elements of a program for controlling animal wastes. (See also W71-03555) (White-Iowa State)
W71-03556

DISTRIBUTION OF ARSENIC FROM POULTRY LITTER IN BROILER CHICKENS, SOIL, AND CROPS,
Salsbury Labs., Charles City, Iowa. Dept. of Biochemistry.
Joseph L. Morrison.
Journal of Agricultural and Food Chemistry, Vol 17, p 1288-1290, November 1969. 5 tab, 27 ref.

Descriptors: *Arsenic, *Farm wastes, *Poultry, Soil, Crops, Assay, Alfalfa, Clovers, Correlation analysis, Groundwater, Pesticides.
Identifiers: *Poultry litter, *Arsenical feed additives, Hydrolized feather meal, Poultry tissue, Roxarsone.

The effect of the presence of organoarsenicals from feed additives in poultry house litter was investigated with respect to the distribution of arsenic in chickens raised on this litter, to the distribution of arsenic in soil fertilized with this litter, and to the distribution of arsenic in crops raised on soil fertilized with this type litter. Although measurable amounts of arsenic (15-30 ppm) were found in the litter, the arsenic content of soil and crops was unaffected by the use of poultry litter as fertilizer. Similarly, the arsenic content of birds was unaffected when raised on this type litter. (White-Iowa State)
W71-03565

SURFACE RUNOFF AND NUTRIENT LOSSES OF FENNIMORE WATERSHEDS,
Wisconsin Univ., Madison. Dept. of Agricultural Engineering. State of Wisconsin.
S. A. Witzel, Neal E. Minshall, M. Starr Nichols, and John Wilke.
Transactions of the ASAE, Vol 12, No 3, 1969, p 338-341. 4 tab, 3 fig, 5 ref.

Descriptors: *Surface runoff, *Nutrients, Fertilizers, Farm wastes, Nitrogen, Phosphorus, Potassium, Wisconsin, Agricultural watersheds, Discharge, Soils, Topography, Geology, Cover crops, Weirs, Precipitation, Snow.
Identifiers: *Runoff sampler, Fennimore, Wisconsin.

The paper describes the soils, geology, topographic features and cover of a 330 acre watershed near Fennimore, Wisconsin. The watershed was subdivided and wiers were placed with semi-automatic runoff samplers to sample winter runoff water. The amount of commercial fertilizer as well as manure that was applied was determined. The runoff samples were analyzed and the amount of nutrients lost was calculated from the wier calibration. The amount of runoff during the winter of 1967 was about twice the 29 year average. The nutrients lost in surface runoff were much greater than those in the base flow of southwestern Wisconsin streams. In a year of average runoff, assuming nutrient losses directly proportional to runoff, the losses would be 2 lb. nitrogen, 0.6 lb. phosphorus and 4 lb. potassium per acre. (White-Iowa State)
W71-03571

NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
B. A. Stewart, F. G. Viets, Jr., G. L. Hutchinson, and W. D. Kemper.
Environmental Science and Technology, Vol 1, No 9, p 736-739, September 1967. 2 fig, 1 tab, 1 ref.

Descriptors: *Nitrogen, *Nitrates, *Farm wastes, Groundwater, Water pollution, Water table, Soils,

Irrigation, Fertilizers, Precipitation, Corn, Hydraulic conductivity, Carbon, Oxidation-reduction potential, Alfalfa, Ammonium compounds, Colorado.
Identifiers: Feedlots, Soil cores, Groundwater pollution, South Platte.

Agriculture's effect on nitrate pollution of groundwater was investigated in the South Platte valley of Colorado. The valley is intensively farmed and contains many concentrated livestock feeding operations. A water table, generally between 3 and 20 meters below the surface, underlies much of the area. The average total nitrate-nitrogen to a depth of 6.7 meters in the profiles for the various kinds of land use was: alfalfa (13 cores), 70; native grassland (17 cores), 81; cultivated dry land (21 cores), 233; irrigated fields not in alfalfa (28 cores), 452; and feedlots (47 cores), 1282 kg. per hectare. Groundwater samples often contained high concentrations of nitrate, and those obtained beneath feedlots contained ammonium-nitrogen and organic carbon. (White-Iowa State)
W71-03575

SWINE WASTE MANAGEMENT - PROPERTIES OF SWINE WASTES,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Arthur J. Muehling.
Cooperative Extension Service, University of Illinois at Urbana-Champaign, August 1969. 2 p. AEng-876.

Descriptors: *Farm wastes, *Physical properties, *Chemical properties, *Biological properties, Hogs, Antibiotics, Nitrogen, Potash, Biochemical oxygen demand, Chemical oxygen demand, Nutrients, Animal physiology, Biological treatment.
Identifiers: *Daily production, *Fertilizer value, Phosphoric acid, Population equivalent, Feed ration, Solids.

An understanding of the properties of swine wastes is necessary to develop an adequate system of waste management. The properties of swine wastes as classified by this fact sheet are physical, chemical, and biological. The physical and chemical properties may be affected by the physiology of the animal, the feed ration, and the environment. The quality of feed influences the amount the hogs will eat and the chemical composition of the wastes. The physical properties of daily production and amount of solids are listed by this fact sheet. The fertilizer value of swine manure is shown and the amounts required to obtain certain pounds per acre of nitrogen, potash, and phosphoric acid are told. Average values for BOD, COD and population equivalent are listed as biological properties of swine manure. (White-Iowa State)
W71-03588

PHOSPHORUS CONTENT IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
John A. Schleicher, and John K. Kuhn.
Illinois Geological Survey Environmental Geology Notes No 39, November 1970. 15 p, 12 fig, 4 tab, 5 ref.

Descriptors: *Phosphorus, *Bottom sediments, *Lake Michigan, Pollutant identification, Path of pollutants, Water pollution sources, Sampling, Chemical analysis, X-ray fluorescence, X-ray spectroscopy.
Identifiers: Southern Lake Michigan.

177 samples from unconsolidated sediments on the bottom of Lake Michigan were analyzed by X-ray fluorescence spectrography for total phosphorus content; the samples, from varying depths, were taken from 56 locations. Statistical analyses of the results show that although the concentrations of phosphorus are uniformly rather low, correlations can be shown between the phosphorus content and, notably, the amounts of arsenic, iron, and organic carbon. (Knapp-USGS)
W71-03703

WATER POLLUTION IN LAKE MICHIGAN BY TRACE ELEMENTS FROM POLLUTION AEROSOL FALLOUT,
Michigan Univ., Ann Arbor.
John W. Winchester, and Gordon D. Nifong.
Contribution 161, Dept of Meteorology and Oceanography, (1970). 29 p, 14 tab, 1 fig, 22 ref. USAEC Contract AT (11-1)-1705.

Descriptors: *Lake Michigan, *Water pollution sources, *Water pollution, *Air pollution, *Air pollution effects, *Water quality, Urbanization, Cities.
Identifiers: *Metropolitan areas, *Chicago metropolitan area, *Milwaukee metropolitan area, *Northwestern Indiana metropolitan area, Urban environment.

Certain trace elements which are strongly associated with air pollution sources in the Lake Michigan basin may be contributing significantly to lake water pollution by an atmospheric fallout route. A partial inventory of air pollution emissions for 30 trace elements is presented for the Chicago, Milwaukee, and northwest Indiana metropolitan areas, based on available published information, and compared with natural and pollution stream trace element inputs. Evidence indicates that the atmosphere may be the major source of Zn in Lake Michigan, and atmospheric inputs of Cu and Ni are also considerable. Moreover, the evidence suggests that air pollution probably exceeds expected unpolluted stream inputs for many additional elements in Lake Michigan, highlighting the need for more comprehensive chemical data to quantify the evaluation. (Davis-Chicago)
W71-03764

DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT VOLUME I TEST-CASE STUDIES,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
G. A. Lutz, S. B. Gross, J. B. Boatman, P. J. Moore, and R. L. Darby.
Available from NTIS as PB-194 398, $3.00 in paper copy, $0.95 in microfiche. Final Report, July 1967. 146 p. PHS Contract PH-86-66-165.
Identifiers: *Hazardous materials, Evaluation, *Pollution, Hazardous materials, *Public health, Human ecology, Toxic diseases, Mercury, Vanadium, Nickel, Fluorohydrocarbons, Paper industry, Pulp mills, Dosimetry, *Environmental health hazards.

The report is an initial effort in the development of a program that allows the Public Health Service to maintain an active overview of chemical contaminants that are now, or are likely to be, present in the environment. To illustrate the methods of applying the approach, as well as to develop the base for considering eventually all possible hazards, five specific contaminant classes are selected for individual treatment in separate sections following the general discussions. These sections summarize the contamination potentials of mercury, vanadium, nickel, fluorocarbons, and pulp and paper production, respectively. (See also W71-03771)
W71-03770

DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT. VOLUME II. THE OVERVIEW SYSTEM,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
G. A. Lutz, S. B. Gross, J. B. Boatman, P. J. Moore, and R. L. Darby.
Available from NTIS as PB-194 399, $3.00 in paper copy, $0.95 in microfiche. Final report, July 1967. 85 p. PHS Contract PH-86-66-165.
Identifiers: *Hazardous materials, Evaluation, *Pollution, *Information centers, *Public health, Human ecology, Toxic diseases, Data processing, Management systems, Warning systems, Forecasting, *Environmental health hazards, *Environmental health overview centers.

The United States Public Health Service, Office of Environmental Health, conceived a project to develop a mechanism for evaluating existing information and reducing it to manageable proportions and forms which would enable it to better carry out its responsibilities in research and control programs. The needed mechanism was considered to be a system which would provide an overview and identification of those activities which might lead to public-health hazards. A system design study verified this concept utilizing an overview information center to provide the necessary hazards-identification, evaluation, and alerting system. (See also W71-03770)
W71-03771

DIGITAL SYSTEMS FOR ON-SITE DATA COLLECTIONS FOR WATER QUALITY ANALYSIS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
M. K. Testerman.
Available from NTIS as PB-197 116, $3.00 in paper copy, $0.95 in microfiche. Arkansas Water Resources Research Center, Publication No. 8, Fayetteville, 1970. 58 p, 2 tab, 26 fig, 3 ref, append.

Descriptors: *Data processing, Design criteria, Digital computers, Electronic equipment, *On-site data collection, *Monitoring, *Data transmission, *Data collections, Water quality, *Pollutant identification, Analytical techniques, Instrumentation.

A prototype system has been developed for recording and transmitting digital data at a remote water quality monitoring station in an unattended manner. As many as eight analog signals from transducers, which measure water quality characteristics such as dissolved oxygen, temperature, pH, chlorides, conductivity, redox, and turbidity, are converted to digital signals and recorded in binary coded decimal format on magnetic tape. This unit may be contacted from a central station for playback of the day's recording. The transmitted data can be recorded at the central station by teletype. Each data record includes a time-of-day 'word' so that all data is identifiable. The techniques developed during this contract period have possible application in many areas of water resource research, particularly for use in making water quality measurements in remote areas or at numerous sites report to one central station.
W71-03782

5B. Sources of Pollution

RELATIONSHIP BETWEEN POLLUTION INDICATOR ORGANISMS AND THE SALINITY OF MISSISSIPPI'S ESTUARINE WATERS,
Gulf Coast Research Lab., Ocean Springs, Miss.
For primary bibliographic entry see Field 05A.
W71-03387

SOME CONSIDERATIONS FOR WATER QUALITY AND ENVIRONMENTAL PROTECTION IN WILD AND SCENIC RIVER DEVELOPMENT: THE CHATTOOGA RIVER - A CASE STUDY,
Forest Service (USDA). Southern Region.
For primary bibliographic entry see Field 05G.
W71-03388

TEMPERATURE STUDIES OF AN INTERTIDAL ZONE OF AN ESTUARY,
Central Electricity Generating Board, London (England).
J. F. Spencer.

ymposium on Marine Biology, October 2, 1969, p
-11. 8 fig. Laboratory Memorandum RD/L/M/
69.

)escriptors: *Thermal pollution, *Water tempera-
ıre, *Estuaries, Heat transfer, Instrumentation,
Tidal effects, Nuclear power plants.
lentifiers: Temperature gradients, Blackwater
stuary.

ı order to understand the effect of additional tem-
erature variations due to power station operation,
is necessary to study the natural seasonal tem-
erature ranges and the frequency and magnitude
the short term temperature variations of the in-
rtidal zone. An automatic data-recording system
ith thermistor probes for measuring the tempera-
re of intertidal zones is described. During a single
w tide period, variations in temperature of up to
) deg C and rates of change in temperature of 1
:g C/min have been recorded 1 cm below the sur-
ce. At a depth of 20 cm the changes in tempera-
re were slight. The temperature gradient in the
il may at times change rapidly. The intertidal
ne acts as a variable area radiator constantly ab-
rbing and re-radiating heat. In the Blackwater
tuary the heat exchanged at spring flood tides,
ıen the intertidal zone is cooled to a depth of 30
ı by an average of 1 deg C, was estimated to be
out 6.0 x 10 to the 12th power cals (24 Tera
ules). This value is equivalent to one-third of the
at discharged by Bradwell Nuclear Power Station
60 MW capacity) in 24 hours. The results of
me observations in Milford Haven are also given.
/padhyaya-Vanderbilt)
71-03467

AMPLING CONSIDERATIONS IN STREAM
SCHARGE AND TEMPERATURE MEASURE-
ENTS,
tsburgh Univ., Pa.
r primary bibliographic entry see Field 07B.
71-03476

EATED SURFACE JET DISCHARGED INTO A
OWING AMBIENT STREAM,
nderbilt Univ., Nashville, Tenn. Dept. of En-
onmental and Water Resources Engineering.
uis H. Motz, and Barry A. Benedict.
ailable from Vanderbilt University School of En-
eering, Nashville, Tenn. 37203. Price: $3.00.
tional Center for Research and Training in the
drologic and Hydraulic Aspects of Water Pollu-
n Control, Report No 4, August 1970. 207 p, 75
16 tab, 48 ref.

scriptors: *Cooling water, *Thermal pollution,
ts, *Turbulent flow, *Heated water, *Thermal
ver plants, Thermal stratification, Diffusion,
ter temperature, Heat exchange, Temperature.
ntifiers: *Heat discharge, Density differences,
oyant Jets, Ambient Fluids, Temperature
files, Widows Creek, New Johnsonville, Wau-
an Surveys.

e temperature distribution in the water body due
discharge of waste heat from a thermal-electri-
plant, is a function of the hydrodynamic varia-
s of the discharge and the receiving water body.
e temperature distribution can be described in
ns of a surface jet discharging at some initial
le to the ambient flow and being deflected
vnstream by the momentum of the ambient
ocity. This report considers only the problem of
face jets. It is assumed that in the vicinity of the
face jet, heat loss to the atmosphere is negligi-
It is concluded that the application of the two
ensional surface jet model is dependent on the
ocity ratio and the initial angle of discharge, the
ıe of the initial Richardson number, as low as
2, and the intensity of the ambient turbulence.
temperature distribution can be described in
ns of a surface jet, as long as the initial direction
he discharge velocity is significantly different
n the direction of the ambient current. Both
oratory and field data are used for vertification
he model which has been developed. (Herrera-
ıderbilt)
W71-03478

AGRICULTURE POSES WASTE PROBLEMS.

Environmental Science and Technology, Vol 4, No 12, p 1098-1100, December 1970. 2 fig.

Descriptors: *Farm wastes, *Pollutants, *Wastes identification, *Environmental effects, Water pollution sources.
Identifiers: *High intensity farming, Contamination, Plant emissions, Government action.

Increasing concentration and intensity of agricultural activities necessary to the development and prosperity of the economy, are responsible for many new environmental issues. Primary sources of pollution resulting from agricultural practices can be grouped as: animal wastes, wastes from processing of raw agricultural products, rural domestic wastes, and sediment from land; also plant nutrients from fertilizers, inorganic salts and minerals resulting from irrigation, pesticides, aeroallergens and infectious agents contribute to the problem; particulate and gaseous substances derived from the combustion of wastes and natural plant emmissions add to the problem. A brief description of these sources and some possible solutions are presented. (Christenbury-Iowa State)
W71-03537

URINARY CREATININE AS AN INDEX COMPOUND FOR ESTIMATING RATE OF EXCRETION OF STEROIDS IN THE DOMESTIC SOW,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05A.
W71-03538

RELATIONSHIP OF AGRICULTURE TO SOIL AND WATER POLLUTION.
Cornell Univ., Ithaca, N.Y.

Proceedings, Cornell University Conference on Agricultural Waste Management, January 19-21, 1970. Ithaca, 1970. 270 p.

Descriptors: *Soils, *Farm wastes, *Fertilizers, Groundwater, Precipitation, Potassium, Poultry, Cattle, Hogs, Nitrogen, Nitrate, Phosphorus, Phosphates, Rates of application, Nutrients, Effluent, Aquifer, Ammonia, Soil contamination, Water pollution, Water table, Oxidation lagoon, Irrigation, Aeration, Biochemical oxygen demand, Chemical oxygen demand, Odor, Biological treatment, Costs, Denitrification, Nitrification, Sludge, Storage, Nutrient requirements, Florida, Nebraska, Surface runoff, Infiltration.
Identifiers: *Feedlots, Oxidation ditch, Slotted floors, Aerator, Spreading, Land disposal.

The 1970 Conference attempted to bring knowledgeable individuals from many disciplines together to discuss various aspects of the problem. It was designed to serve as a mechanism for transmitting new research findings to those interested in this area and to demonstrate that agriculture is aware of its potential contributions to environmental pollution as well as its responsibility to society to find methods of alleviating such pollution while increasing the efficiency of production. The Conference played a useful role in providing communication across disciplines. Thirty-two papers are published in the proceedings dealing with all areas of agricultural pollution. (See also W71-03543 thru W71-03554) (White-Iowa State)
W71-03542

GROUNDWATER QUALITY AND FLUCTUATIONS IN A SHALLOW UNCONFINED AQUIFER UNDER A LEVEL FEEDLOT,
Department of Agriculture, Lincoln, Nebr.
L. N. Mielke, J. R. Ellis, N. P. Swanson, J. C. Lorimor, and T. M. McCalla.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 31-40. 2 tab, 4 fig, 13 ref.

Descriptors: *Farm wastes, *Cattle, *Groundwater, *Nitrate, Aquifer, Discharge, Aquifer characteristics, Effluent stream, Groundwater recharge, Transmissivity, Water level fluctuations, Ammonia, Nebraska, Soil contamination, Observation wells, Water table, Infiltration.
Identifiers: *Feedlot, Platte River Valley.

The quality was investigated of the groundwater in the proximity of a level feedlot on a permeable soil with fluctuating high water table. At the feedlot site, the aquifer consists of 30-35 feet of high quality gravel having a coefficient of transmissibility in the range of 90,000-120,000 gallons per day per foot. Aquifer recharge occurs as a result of direct precipitation and interflow from the valley uplands. Six observation wells were installed in the vicinity of the feedlot as well as six water level measuring wells. Two recording wells, constructed of 4-inch diameter aluminum irrigation pipe, were jetted into the gravel aquifer. The water table depth at the feedlot varies with the season. Groundwater level changes reflect major rainstorms within hours after the event. The maximum groundwater elevation under the feedlot was approximately 2 feet below the soil surface. Soil cores were taken to determine the quantity of nitrate which could move into the water table. Low levels of nitrate were found below the first foot. Ammonia was present in only moderate amounts below 3 feet (A30ppm) and rapidly decreased in concentration with increased depth to the water table. Analysis of the core samples indicated that downward movement of nitrates and other forms of nitrogen in the soil was minor. The 12-15 inches of manure pack decreased the actual penetration depth of the nitrogen into the profile. Some samples exhibited levels of nitrate that exceeded Public Health standards (10ppm). This may have been due to the application of anhydrous ammonia prior to the first irrigation. Generally, the nitrate analysis showed relatively low nitrate level in the profile. (See also W71-03542) (White-Iowa State)
W71-03543

THE NITROGEN CYCLE OF A DAIRY FARM,
Connecticut Agricultural Experiment Station, New Haven.
C. R. Frink.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 127-133. 4 fig, 1 tab, 11 ref.

Descriptors: *Nitrogen, *Nitrogen cycle, Farm wastes, Nutrients, Fertilization, Foliar application, Corn, Silage, Efficiencies, Nitrate, Groundwater, Ureas.
Identifiers: *Nitrogen conversion, Yield, Foliar fertilization.

Analyses of nutrient cycling on dairy farms in the Northeast have shown that significant quantities of nitrogen may be lost to groundwater. Calculations of the efficiency of nitrogen conversion on these farms revealed that losses to the environment increased dramatically as farm size decreased. Milk production was not affected by the increased nitrogen imported onto the farm while yields of corn silage increased only slightly. Thus, the total nitrogen imported onto the smaller farms could apparently be reduced without seriously reducing productivity. In addition, losses to the environment during cycling of the required amounts of nitrogen can be reduced by foliar applications to the growing crop, selection of varieties with high yield and nitrogen content, increased plant populations, and more extensive use of cover crops. (See also W71-03542) (White-Iowa State)
W71-03549

HYDROLOGIC STUDIES FOR EVALUATION OF THE POLLUTION POTENTIAL OF FEEDLOTS IN EASTERN NEBRASKA,
Department of Agriculture, Lincoln, Nebr.
Norris P. Swanson, Lloyd N. Mielke, and Jeffery C. Lorimor.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 226-232. 15 ref.

Descriptors: *Farm wastes, *Cattle, *Runoff, Overland flow, Surface runoff, Infiltration, Water pollution, Erosion, Evaporation, Discharge, Settling basins, Precipitation, Slopes, Storage, Time, Nebraska.
Identifiers: *Feedlots, Mulch, Water stage recorder, Manure pack, Intensity.

Four questions are discussed which arise as a result of large numbers of cattle contained in feedlots in eastern Nebraska. There were two primary objectives of the research. First, the annual water balance of the feedlots was to be defined. The second objective was to characterize the water leaving the feedlots in overland flow or by percolation through the profile. The data collected provide only rough comparison, but should serve to put the probable runoff, erosion, and infiltration, or retention of water on a feedlot into perspective with the better known hydrologic characteristics of cropped land. In eastern Nebraska, this can be summarized as follows: (1) Infiltration on an established beef feedlot appears to be restricted to water storage in the manure pack, with very limited water movement through the profile; (2) the runoff from a feedlot, and hence the pollution potential, is a function of the area of the lot; (3) annual runoff from a beef feedlot may be two or three times that of adjacent cropland, and (4) despite increased runoff in comparison adjacent cropland, the protective mulch of the manure pack keeps erosion losses below those of the cropland. (See also W71-03542) (White-Iowa State)
W71-03551

A BALANCE SHEET METHOD OF DETERMINING THE CONTRIBUTION OF AGRICULTURAL WASTES TO SURFACE WATER POLLUTION,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
David A. Schultz.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 251-262. 8 tab, 9 ref.

Descriptors: *Water quality, *Farm wastes, *Nutrients, Nitrogen, Phosphorus, Potassium, Fertilizers, Water pollution, Sediments, Pesticides, Regions, Basins, Time.
Identifiers: *Balance Sheet Method, Nutrient losses, Biologic inputs.

To the extent that the data are accurate, the paper presents a Balance Sheet Method that will show explicitly the quantity of nutrients contributed by agricultural activities to a stream. From this, one can determine the relative importance of agricultural pollution given knowledge of the total amount of nutrient pollution. Combining this information with that available on water quality and contributions from other sources, a waste management association will be able to more accurately determine the share that the agricultural industry will have to pay of the total cost of a program to maintain an abundant quantity of good quality water for all uses. Using this general method as well as modifying and improving the procedure will aid society's efforts toward effective water pollution control for all rivers and lakes in the United States. (See also W71-03542) (White-Iowa State)
W71-03553

DISTRIBUTION OF ARSENIC FROM POULTRY LITTER IN BROILER CHICKENS, SOIL, AND CROPS,
Salsbury Labs., Charles City, Iowa. Dept. of Biochemistry.
For primary bibliographic entry see Field 05A.
W71-03565

SURFACE RUNOFF AND NUTRIENT LOSSES OF FENNIMORE WATERSHEDS,
Wisconsin Univ., Madison. Dept. of Agricultural Engineering. State of Wisconsin.
For primary bibliographic entry see Field 05A.
W71-03571

THE FARM ROLE IN WATER QUALITY MANAGEMENT,
Soil Conservation Service, Beltsville, Md.
Hollis R. Williams.
Water and Sewage Works, Vol 115, October 1968, p 463-464.

Descriptors: *Farm wastes, *Sediments, *Fertilizers, Insecticides, Herbicides, Water pollution, Watershed Protection and Flood Prevention Act, Channels, Cattle, Poultry, Pollution abatement.
Identifiers: Soil Conservation Service.

This article is based on information contained in an address by Williams to the Federal Water Quality Association. It is stated that three things find their way from farm lands into waterways to form major pollution problems. These are sediment, agricultural chemicals, and animal wastes. Sediment is the most significant of the three. Sediment also adsorbs phosphate and pesticides and carries them in streams. The major source of sediment is farmland, however, housing developments, new roads and other construction produces extremely large quantities of sediment. Four areas are mentioned which need continuing attention to control the erosion problem. The increased use of fertilizer is pointed out along its pollution capabilities. Research is currently being done to study the behavior of fertilizers, insecticides and herbicides on soils, water and plants. The problem of animal waste is also discussed. Four tools are pointed out as being necessary to achieve the goal of clean rivers and streams and successful control of pollution on farmlands as well as urban areas. (White-Iowa State)
W71-03572

NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05A.
W71-03575

SOURCES OF NITROGEN AND PHOSPHORUS IN WATER SUPPLIES - TASK GROUP REPORT.

Journal of the American Water Works Association, Vol 59, p 344-366, March 1967. 8 tab, 1 fig, 64 ref.

Descriptors: *Nitrogen, *Phosphorus, Farm wastes, Eutrophication, Great Lakes, Distribution, Fertilizers, Ammonia, Nitrates, Nitrites, Phosphorus, Compounds, Domestic wastes, Detergents, Industrial wastes, Nutrients, Fuels, Water treatment, Rivers, Runoff, Drainage water, Sediment transport, Cultivated lands, Water fowl, Atmosphere, Rainfall, Nitrogen fixation.
Identifiers: *Fertilizer consumption, Concentrations, Urban runoff, Dustfall, Historical trends.

The results of this survey have indicated that nitrogen and phosphorus nutrients are contributed to water in significant quantities from a variety of man-made and natural sources. Data taken from a small scale were extrapolated to large areas of the country. This brings attention both on the sources of most significance as well as on the sources for which additional information is most needed. The estimation of nutrient contributions from various sources is presented in tabular form. The complete elimination of nitrogen and phosphorus nutrients from surface water supplies does not appear economically feasible because the sources are so widespread. Therefore, appropriate efforts must be made to cope with many of the problems that have been created, and increased effort must be devoted to the development of better methods for prevention of algal growth in reservoirs. A more concentrated effort by the water utility profession to reduce the detrimental effects caused by eutrophication of water supplies is recommended. (White-Iowa State)
W71-03577

SOIL POLLUTANTS: THEIR ORIGIN AND BEHAVIOR,
Guelph Univ. (Ontario). Dept. of Microbiology.
D. E. Elrick, J. W. Biggar, and L. R. Webber.
Journal Soil Water Conservation, Vol 21, p 7-11, 1966. 3 fig, 26 ref.

Descriptors: *Pollutants, *Pesticide residues, *Degradation (Decomposition), Farm wastes, Pollutant identification, Effluents, Pesticides, Sewage, Domestic wastes, Disposal, 2-4-D, DDT, Chlorides, Radioactive wastes, Air pollution effects.
Identifiers: *Contaminants, Biological contaminants.

Pesticides, industrial and municipal wastes, radioactive materials, microbes, and other potential pollutants are coming in contact with our soil in ever increasing amounts. This article discusses certain sources of soil contaminants and outlines a few of the research techniques being used in an attempt to understand their behavior in soil. Agricultural chemicals may become harmful pollutants if improperly used. Sewage and industrial wastes make up the bulk of contaminating substances produced by our society. Waste disposal related to biological contamination of water supplies by bacteria and viruses. Radioactive contamination and some air pollutants come into contact with the soil. The movement of some of the soil pollutants is discussed. (Christenbury-Iowa State)
W71-03580

A GENERAL NUMERICAL SOLUTION OF THE TWO-DIMENSIONAL DIFFUSION-CONVECTION EQUATION BY THE FINITE ELEMENT METHOD,
California Univ., Davis.
G. L. Guymon, V. H. Scott, and L. R. Herrmann.
Water Resources Research, Vol 6, No 6, p 1611-1617, December 1970. 7 p, 3 fig, 11 ref. NSF Grant GZ-790.

Descriptors: *Diffusion, *Convection, *Linear programming, Mathematical studies, Equations, Computer programs, Numerical analysis, Dispersion, Porous media, Flow, Open channel flow.
Identifiers: *Finite element analysis.

The two-dimensional diffusion-convection equation, together with the appropriate auxiliary conditions, is used to describe approximately the motion of dissolved constituents in porous media flow, dispersion of pollutants in streams and estuaries, energy transfer in reservoirs, and other natural transport processes. The two-dimensional diffusion-convection equation, with an assumed set of auxiliary conditions, is converted to a variational principle for systems that do not involve mixed partials. The variational principle is in turn solved by the Ritz procedure by dividing the domain of interest into an arbitrary number of finite triangular elements. Within each element the unknown function states are represented by a first order space polynomial. The resulting system of first order linear equations is then solved by numerical differentiation using the Adams-Moulton multistep predictor-corrector method. (Knapp-USGS)
W71-03677

UMERICAL SOLUTION TO THE CONVEC-IVE DIFFUSION EQUATION,
attelle-Northwest, Richland, Wash.
. A. Oster, J. C. Sonnichsen, and R. T. Jaske.
Vater Resources Research, Vol 6, No 6, p 1746-752, December 1970. 7 p, 3 fig, 1 tab, 4 ref. AEC ontract AT (45-1)-1830.

escriptors: *Mixing, *Numerical analysis, *Diffu-on, *Dispersion, *Path of pollutants, Water pollu-on effects, Convection, Translocation, Mathe-atical studies, Streamflow, Turbulent flow, Com-uter programs.
entifiers: *Pollutant transport.

numerical solution to the convection diffusion uation is discussed. The case examined treats a nservative waste or pollutant, although the stem is flexible enough to accommodate noncon-rvative substances. The numerical approximation pears stable and can be extended to include anal-is of an n-dimensional array. (Knapp-USGS)
71-03690

ESIGN OF AN OVERVIEW SYSTEM FOR VALUATING THE PUBLIC-HEALTH AZARDS OF CHEMICALS IN THE ENVIRON-ENT VOLUME I TEST-CASE STUDIES,
ttelle Memorial Inst., Columbus, Ohio. Colum-s Labs.
r primary bibliographic entry see Field 05A.
71-03770

ESIGN OF AN OVERVIEW SYSTEM FOR VALUATING THE PUBLIC-HEALTH AZARDS OF CHEMICALS IN THE ENVIRON-ENT. VOLUME II. THE OVERVIEW YSTEM,
ttelle Memorial Inst., Columbus, Ohio. Colum-s Labs.
r primary bibliographic entry see Field 05A.
71-03771

C. Effects of Pollution

ANIPULATION OF RESERVOIR WATERS OR IMPROVED QUALITY AND FISH POPU-ATION RESPONSE,
isconsin Dept. of Natural Resources, Madison.
r primary bibliographic entry see Field 05G.
71-03307

FFECT OF DDT ON TEMPERATURE SELEC-ON BY YOUNG ATLANTIC SALMON, LMO SALAR,
niversity of Western Ontario, London. Dept. of ology.
M. Ogilvie, and J. M. Anderson.
urnal of the Fisheries Research Board of Canada. l 22, p 503-512, 1965. 4 fig, 15 ref.

escriptors: *Pesticides, *DDT, *Temperature, tlantic salmon, Juvenile fishes, Chlorinated drocarbon, Pesticides, Acclimatization, Insecti-les, Water pollution effects.
entifiers: Sublethal doses, Salmo salar.

posure of Atlantic salmon, Salmo salar, un-ryearlings for 24 hr to sublethal doses of DDT, nging from 5 to 50 ppb, resulted in changes in the ected temperature. Low doses produced a wnwards shift in the selected temperature ereas higher doses produced an upwards shift. e DDT effect appeared to be more marked for rm-acclimated fish (17C) than for cold-accli-ted ones (8C). Exposure of warm-acclimated h to 10 ppb DDT or more appeared to make em extremely sensitive to cold water and there s some evidence to suggest that the lower lethal nit may have been raised. DDT may interfere th the normal thermal acclimation mechanism. Vahtola-Washington)
71-03364

A PRELIMINARY REPORT ON RAPID BIOLOGICAL INFORMATION SYSTEMS FOR WATER POLLUTION CONTROL,
Virginia Polytechnic Inst., Blacksburg, Va.
John Cairns, Jr., Kenneth L. Dickson, Richard E. Sparks, and William T. Waller.
Journal Water Pollution Control Federation, Vol 42, p 685-703, 1970. 1 tab, 22 fig, 22 ref.

Descriptors: *Water pollution control, Systems analysis, Toxicity, *Monitoring, Data collections, Bioindicators, Surveys, Ecosystems, Water quality, Fish, Fish physiology, Fish behavior.

The time required to generate biological information may be reduced according to preliminary results of tests of one in-stream and two in-plant biological monitoring systems studied. A Sequential Comparison Index (SCI) was developed as a rapid method for non-biologists to assess the biological consequences of pollution and express the results numerically. Fish movement patterns and heart and breathing patterns were studied in-plant. Changes in these parameters may indicate toxicant concentrations not detectable by traditional bioassays. (Wahtola-Washington)
W71-03367

INFLUENCE OF BODY WEIGHT ON CHRONIC ORAL DDT TOXICITY IN COHO SALMON,
Bureau of Sport Fisheries and Wildlife, Columbia, Mo. Fish-Pesticide Research Lab.
Donald R. Buhler, and W. E. Shanks.
Journal of the Fisheries Research Board of Canada, Vol 27, p 347-358, 1970. 7 fig, 3 tab, 22 ref.

Descriptors: *DDT, *Pesticides, Weight, *Fish diets, Mortality, Laboratory tests, Bioassay, *Lethal limit, Pesticide removal, Toxicity, Salmon, Water pollution effects, Insecticides.
Identifiers: Coho salmon, *LD50, Body size, *Median survival time, *Pesticide uptake.

Median Survival time was directly proportional to body weight in young coho salmon of the same age that were fed a diet containing technical DDT. Supplementation by additional feeding with DDT-free diet prolonged the lifespan of these fish but the median survival time remained a direct function of body weight. The primary effect of body size on lethality was to control the rate of DDT intake by the fish. The smallest fish consumed the greatest amounts of diet and, consequently, these fish received the highest milligram per kilogram doses of DDT. In addition, however, the smaller salmon succumbed to a lower milligram per kilogram cumulative lethal dose than did the larger fish, perhaps because the smallest fish contained a lower percentage of lipid and thus failed to provide for adequate storage detoxification of the DDT. (Sjolseth-Washington)
W71-03368

TOXICITIES OF SOME HERBICIDES TO SIX SPECIES OF FRESHWATER CRUSTACEANS,
Bureau of Sport Fisheries and Wildlife, Columbia, Mo. Fish-Pesticide Research Lab.
Herman O. Sanders.
Journal Water Pollution Control Federation, Vol 42, p 1544-1550, 1970. 3 tab, 16 ref.

Descriptors: *Pesticides, *Bioassay, *Toxicity, *Crustaceans, Herbicides, Shellfish, Aquatic animals, Water pollution effects, Shrimp, Daphnia, Crayfish, Mortality, Invertebrates.
Identifiers: TL50, Scud, Sowbug, Dichlone.

The relative toxicities of some 37 herbicides to six species of freshwater crustaceans were described. Static bioassays were conducted on scud, glass shrimp, sowbug, crayfish, daphnia, and seed shrimp. Toxic effects were measured by determining the Median Tolerance Limit (TL50) for 24-, 48-, and 96-hr exposures. The 37 herbicides not only differed greatly in toxicity but also exhibit large variations in sensitivity among the six species. The toxicities of different formulations of the same herbicide also differ greatly. Dichlone was the most toxic herbicide tested. Herbicides were generally most toxic to daphnia; following in descending order of sensitivity were seed shrimp, glass shrimp, sowbug, scud, and crayfish. (Wahtola-Washington)
W71-03371

DISTRIBUTION OF INGESTED ZINC-65 IN THE TISSUES OF SOME MARINE CRUSTACEANS,
Oregon State Univ., Corvallis. Dept. of Oceanography.
Scott W. Fowler, Lawrence F. Small, and John M. Dean.
Journal of the Fisheries Research Board of Canada, Vol 27, p 1051-1058, 1970. 3 tab, 2 fig 20 ref. Atomic Energy Commission AT (45-1) 1830, PHS Grant ES00026.

Descriptors: *Heavy metals, Metabolism, Crustaceans, Shrimp, Water pollution effects, *Metals, Marine animals, Rates, Shellfish, *Zinc radioisotopes, Radiochemical analysis, Invertebrates.
Identifiers: Euphausia pacifica, Zn-65, Thysonoessa spinifera.

Autoradiographs of tissues of euphausids and shrimps fed 65Zn through a food chain showed the isotope located primarily in the muscle fibers, in the eye, within the exoskeleton, and on the interior surface of the exoskeleton. Comparisons of the autoradiographic evidence with concentrations of radiozinc and stable sinc in the various dissected tissues were in good agreement. The specific areas of Zinc is highly labile in marine crustaceans and will accumulate in certain specific locations regardless of the mode of uptake. The rates at which various tissues became saturated with 65Zn were dependent upon mode of uptake, however. Because most of the 65Zn was located intracellularly, and not intrcellularly, most ingested zinc apparently accumulates in excess of the animals' needs and is not used metabolically. (Wahtola-Washington)
W71-03372

MINERALIZATION PROCESS OF ORGANIC MATTER IN LAKE WATER,
Nagoya Univ. (Japan). Water Research Lab.
Tadashiro Koyama, and Takao Tomino.
Kyoto University Misaki Marine Biological Institute Bulletin, No 12, p 111-124, February 1968. 14 p, 6 fig, 4 tab, 22 ref.

Descriptors: *Biodegradation, *Organic matter, *Lakes, *Eutrophication, *Water chemistry, Nitrification, Solubility, Solutes, Plankton, Decomposing organic matter.
Identifiers: *Japan.

Studies on the mineralization process of organic matter were carried out in Lake Kizaki-ko (maximum depth: 28.5m), a mesotrophic lake in Navano Prefecture, Japan. The ratio of organic carbon to organic nitrogen was 5.7 in plankton, 9.3 in detritus collected at 25 meters in water, and 15.5 in bottom sediments. During the early stage of the stagnation period, the process of nitrogen fixation is generally a little more active than denitrification, but during most of the stagnation period, denitrification remarkably exceeds nitrogen fixation. At the end of the stagnation period, the amount of denitrified N is considerably larger than other mineralized nitrogenous compounds. Denitrification constitutes the dominant process determining the nitrogen metabolism in the lake water. The average ratio of total mineralized carbon and nitrogen in the lake at the end of the stagnation period was 3.53, a value considerably smaller than the corresponding value for plankton, 5.7. This fact supports the view that the greater ease of decomposition of nitrogenous fraction of dead planktonic material as compared with that of the carbonaceous fraction causes the increase in the ratio of Org.C/Org.N towards the bottom. (Knapp-USGS)
W71-03435

REPORT OF NATIONALLY DESIGNATED EXPERTS ON EUTROPHICATION CONTROL.
Organization for Economic Co-Operation and Development, Paris (France).

Organization for Economic Co-Operation and Development, Ex 40103, 1970. 34 p, 5 append.

Descriptors: *Conferences, *Eutrophication, *Control, *Foreign research, Water quality, Water pollution effects, Water pollution sources, Integrated control measures, Legal aspects, Fertilizers, Detergents, Water resources, Investment, Costs.
Identifiers: *OECD, *Water Management Research Group, Development projects, Canada, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, United States.

This report, submitted in 1969 by delegates of different countries, contains a review of problems and control measures of water eutrophication. The document raises several legal issues relative to the agricultural use of fertilizers and the sale of phosphorus-free detergents. Five appendices include a list of representatives of different nations, a list of submitted national reports, and proposals for measurements of essential factors of eutrophication. (Wilde-Wisconsin)
W71-03443

SCIENTIFIC FUNDAMENTALS OF THE EUTROPHICATION OF LAKES AND FLOWING WATERS, WITH PARTICULAR REFERENCE TO NITROGEN AND PHOSPHORUS AS FACTORS IN EUTROPHICATION,
Organization for Economic Co-Operation and Development, Paris (France).
Richard A. Vollenwider.
Organization for Economic Co-Operation and Development, Ex 40105, 1970. 193 p, 34 fig, 41 tab.

Descriptors: *Eutrophication, *Phosphorus, *Nitrogen, Lakes, Rivers, Impoundments, Aquatic life, Plankton, Biomass, Productivity, Trophic level, Nutrients, Water pollution control, Water pollution effects, Water pollution sources, Waste water treatment, Inorganic compounds.
Identifiers: *OECD, *Committee for Research Cooperation, Aquatic blooms, Hydrophytes, Nutrient sources, Nutrient concentration.

These 160 pages of text, supplemented by many diagrams (and a bibliography (See W71-03448) issued separately) are described as a report. In actuality this volume is a textbook-like monograph covering a good many aspects of inorganic water eutrophication, particularly that caused by nitrogen and phosphorus. The subjects which were given primary attention in the 7 chapters of the volume include physiology and ecology of bloom-forming organisms; relation between the biomass of plankton and trophic level of waters; sources, supply, and critical concentration of nutrients; elimination of phosphorus and nitrogen from wastewaters. A considerable fraction of the assembled information could be well incorporated into a textbook on the subject. (Wilde-Wisconsin)
W71-03447

BIBLIOGRAPHY: SCIENTIFIC FUNDAMENTALS OF THE EUTROPHICATION OF LAKES AND FLOWING WATERS, WITH PARTICULAR REFERENCE TO NITROGEN AND PHOSPHORUS AS FACTORS IN EUTROPHICATION,
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 10.
W71-03448

CHANGES IN THE BLOOD OF BROOK TROUT (SALVELINUS FONTINALIS) AFTER SHORT-TERM AND LONG-TERM EXPOSURE TO COPPER,
National Water Quality Lab., Duluth, Minn.
J. M. McKim, G. M. Christensen, and E. P. Hunt.
Journal of the Fisheries Research Board of Canada, Vol 27, No 10, p 1883-1889, 1970. 1 tab, 1 fig, 27 ref. FWQA Project 18050 ETN 12/70.

Descriptors: *Brook trout, *Trout, *Toxicity, *Copper, Water pollution effects, Pollutant identification, Analytical techniques.
Identifiers: *Blood change, Plasma.

Seven blood characteristics--red blood cell count (RBC), hematocrit (Hc), hemoglobin (Hb), plasma chloride (Cl), plasma glutamic oxalacetic transaminase (PGOT), L-aspartate: 2-oxoglutarate amino transferase), osmolarity (Os), and total protein (TP)--were measured in brook trout (Salvelinus fontinalis) that had been exposed to three concentrations (67.5-69.2, 38.2-39.0, and 22.8-24.0 ug/liter) of Cu (II) for 6 and 21 days. Concentrations of 67.5-69.2 and 38.2-39.0 ug/liter caused statistically significant increases in RBC, Hc (6-day only), Hb, PGOT, and TP (6-day only), whereas Cl and Os decreased during both exposure periods. Five blood characteristics (RBC, Hb, Hc, Cl, and PGOT) were also measured in brook trout, which were exposed for 337 days to Cu (II) concentrations of 32.5, 17.4, 9.5, 5.7, and 3.4 ug/liter. After this long-term exposure, no changes were observed in the blood except for a measurable decrease in PGOT values at 32.5 and 17.4 ug/liter. The disappearance of initial blood changes, after extended exposure, suggests the transient nature of these early responses. Application of this study to the evaluation of the physical condition of fish and the possible long-range forecasting of reproductive success and survival of a species is discussed.
W71-03450

MOLLUSCS FROM A POWER STATION CULVERT,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
D. S. Davis, and W. R. White.
Journal of Conchology, Vol 26, No 1, p 33-38, 1966. 2 fig, 1 tab, 6 ref.

Descriptors: Power plants, *Fouling, *Molluscs, *Mussels, Water pollution effects.
Identifiers: Intake culvert.

The objective was to gain information on the fouling which may be of use in devising control measures. The samples were taken to study the settlement of the edible mussel which grows in large numbers in the culvert. If left unchecked these growths of mussels may cause reductions in the water flow and blocking of condenser tubes which can decrease the efficiency of the power station and consequently increase the cost of electricity generation. The samples collected were initially preserved in 5 percent formation in sea water but later transferred to sea water. The collections made from the culvert have provided some 34 species. The species recorded are listed, with appropriate notes, according to the system and nomenclature employed by Winckworth. The occurence of various mollusc species in the samples are given in a table. The many dead shells and the distorted shells of living specimens indicate the large-scale settlement of larvae on to a substrate which is totally unsuitable for the adults. This feature is particularly well shown by those pelecypods which normally have a burrowing habit, e.g. Venerupis and Petricola pholadiforms. (Upadhyaya-Vanderbilt)
W71-03468

SOME EFFECTS OF HEATED EFFLUENTS ON MARINE PHYTOPLANKTON,
Central Electricity Generating Board, London, (England).
P. D. V. Savage.
Symposium on marine biology, p 27-32, October 2, 1969. 3 fig, 1 tab, 4 ref. Laboratory memorandum RD/L/M 269.

Descriptors: *Thermal pollution, *Phytoplankton, *Food chains, Power plants, Estuaries, Cooling water, Carbon radioisotopes, Plant physiology, Photosynthesis, Water pollution effects.
Identifiers: *Marine environment.

Phytoplankton species, as primary producers, play a fundamental role in marine food chains. In situ measurements of the effects on phytoplankton of passage through power station condensers is made. In situ measurements of the carbon assimilation rates of natural phytoplankton populations at the different temperatures was made using the 14C technique as recommended by Steemann Nielesen. Over the course of the year there appeared to be no significant difference between the carbon-assimilating capacities of heated and unheated samples. Regular microscopical examination of samples show no apparent increase in the number of dead cells in outfall samples. Effect of the duration of exposure to elevated temperatures on subsequent growth of Isochrysis galbana in culture is shown in two figures. Existing knowledge of algal physiology indicates that over limited temperature ranges above the optimum, the inactivation of biochemical components of cells is reversible. Such effects might well occur in marine phytoplankton. (Upadhyaya-Vanderbilt)
W71-03469

THERMAL POLLUTION THREAT DRAWS NEARER,
E. E. Dallaire.
Civil Engineering, p 67-71, October 1970. 3 fig.

Descriptors: *Thermal pollution, *Nuclear power plants, *Temperature, Ecology, Cooling towers, Fish.
Identifiers: Temperature standards, Waste heat.

The thermal pollution threat will be met by, disposing of excess heat through cooling towers, cooling ponds, or spray ponds, by upgrading power generating efficiency, by managing the receiving waters to reduce the harmful impact of heat on water bodies and by making use of waste heat. Increase in temperature of the water body causes increase in metabolism, decrease in reproductive ability of fish and other organisms. They become more susceptible to disease and poisoning and their ability to catch food decreases. Recent biological studies at several power plant sites around the U. S. found that thermal discharges had no significant short-term impact on aquatic life. The use of evaporative cooling tower rather than once-through systems increases the cost of generating power by about 5%. Some of the more frequently heard proposals for putting this heat to good use include space heating, industrial processes, agriculture, aquaculture, water and waste treatment, desalinization, de-icing harbors, and recreation. Temperature recommendations proposed by the National Technical Advisory Committee on water quality standards are discussed. (Upadhyaya-Vanderbilt)
W71-03470

BENEFICIAL USES OF THERMAL WATER,
Vitro Corp. of America, Portland, Oreg. Portland Operation.
Herman H. Miller, Jr.
Thermal Water Horticultural Demonstration Project at Springfield, Oregon, Chemurgic Council 32nd Annual Conference, Washington, D.C., October 22-23, 1970. Typescript. 6 p.

Descriptors: *Thermal water, *Sprinkler irrigation, *Irrigation, Water reuse, Horticulture, Demonstration farms, Drainage, Cooling water, Thermal pollution, Cooling towers.
Identifiers: Springfield, Oregon.

The utilization of thermal waters from industry in a multi-use concept that would benefit the public, industry and agriculture is treated in this paper. A field-demonstration project for agriculture is presented. Programs such as: Frost protection, plant cooling, irrigation, soil heating and drainage

studies are analyzed. A critical factor in frost protection by sprinkler application is the proper management of water application to preclude limb breakage, as a result of ice formation, which can cause breakage loss to trees that exceeds the loss caused by frost. Warm water from sprinklers can be used to cool plants during warm, dry summer months. The project demonstrates how this procedure reduces sunscald, eliminates cold water shock, increases yields and improves the quality of crops. Broad irrigation effects of thermal water are being monitored on the project. (Herrera-Vanderbilt)
W71-03471

HEAT TRANSIENTS AND ECOLOGY,
Central Electricity Generatirng Board, London, England).
J. Holmes.
Symposium on marine biology, p 50-51, October 2, 1969. 1 ref. Laboratory memorandum RD/L/M 69.

Descriptors: *Thermal pollution, *Ecology, Power plants, Coasts, Temperature.
Identifiers: Heat transients.

The stream of warmed water from a coastal power station may produce marked local heating effects or in excess of the average level of heating in the outfall area. As the sea surface rises and falls with the tide, this warmed layer comes into contact with varying areas of the sub-littoral zone. The behavior of shore animals under steady temperature conditions gives little guide to their probable reactions to these rapidly changing temperature. The presence of under and overshoot effects may be particularly significant. At lower, sublethal, values constantly varying temperatures affect feeding efficiency, food conversion, growth rate and gonad maturation. (Upadhyaya-Vanderbilt)
W71-03472

PHYSICAL AND ECOLOGICAL EFFECTS OF WASTE HEAT ON LAKE MICHIGAN.
Fish and Wildlife Service, United States Department of the Interior, September 1970. 101 p, 7 fig, 24 tab, 60 ref.

Descriptors: *Thermal pollution, *Lake Michigan, *Heated water, *Aquatic environment, *Water temperature, Fish kill, Aquatic habitats, Ecological effects, Wild life, Eutrophication.
Identifiers: *Waste heat, *Inshore waters, Thermal loadings, Thermal tolerances, Fishery resource.

The purpose of the present report is to analyze the ecological damages to Lake Michigan as a result of the discharge of industrial and municipal waste heat. Since not enough data are available about these effects, interview standards must be set for Lake Michigan on the basis of existing knowledge. This paper presents the available evidence that substantiates this concern. Heat addition is an essentially accumulative problem that would contribute to inshore eutrophication and be intolerable for the fish and wildlife standpoint by the year 2000. Analysis of inshore waters, thermal loadings, effects of temperature fluctuation on Lake Michigan fish and ecological ramifications of the addition of waste heat are presented and discussed. Among the conclusions based on the evidence presented in the report, it is stated that no significant amounts of waste heat should be discharged into Lake Michigan. (Herrera-Vanderbilt)
W71-03474

WATER QUALITY AND POWER PLANTS,
Duke Power Co., Charlotte, N.C.
Austin C. Thies.
Edison Electric Institute Bulletin, p 201-206, June-July 1969. 9 fig.

Descriptors: *Thermal pollution, *Water cooling, *Heated waters, *Power plants, Industrial water, Fishkill, Wildlife, Dissolved oxygen, Aquatic habitats.

Analysis and discussion on what industry has done to minimize the effect of heated discharges from power stations to the receiving waters is presented in this paper. It is stated that industries are carrying out many studies on the biological effects of heated water discharges on Biota at actual power plant sites. There is a good evidence that adding large amounts of heat to water in itself is not likely to have harmful effects on the life in and around the water at low temperatures. However, when additions are on a long series of hot days at low river-flows in areas where sewage wastes are dumped, the balance of life in and around the water will be upset in a variety of ways, some of which are harmful. Industry must avoid these kind of changes. (Herrera-Vanderbilt)
W71-03475

MARINE BIOLOGY AND ELECTRICITY PLANNING,
Central Electricity Generating Board, London (England).
D. Clark.
Symposium on Marine Biology, October 2, 1969, p 4-7. Laboratory Memorandum RD/L/M 269.

Descriptors: *Power plants, *Thermal pollution, Planning, Marine plants, Cooling towers, Estuaries.
Identifiers: Siting power stations.

It is at the planning stage that the environmental impact of a new project is largely determined. A dry tower is about three times as bulky as the equivalent wet tower and is much more costly. The demands of a large modern station far exceed the dry-weather flows of even our largest rivers. With limitations on inland water resources more power stations have been established on estuaries and the coast, mostly using direct cooling. It is concluded that planning engineers and biologists must keep each other informed when a new plant is planned. (Upadhyaya-Vanderbilt)
W71-03477

FUTURE USE OF THE CHESAPEAKE BAY FOR COOLING THERMAL DISCHARGES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography.
Derek K. Brady, Arthur S. Brooks, Norman L. Buske, Graves L. Willard, Jr., and John F. Hoffman.
Water Sciences and Management Program, Seminar Report, July 1969, 262 p. 35 fig, 19 tab, 182 ref.

Descriptors: *Thermal pollution, *Thermal capacity, *Cooling waters, Aquatic environment, Recreational activities, Solar radiation, Temperature, Stagnant water, Aquatic plants, Aquatic animals.
Identifiers: *Chesapeake Bay, *Biological effects, *Heat disposal.

The surface cooling and advective heat capacity of the Cheasapeake Bay is estimated to be of sufficiently great magnitude to warrant the utilization of the estuary's cooling capacity. However, uniform distribution of the surplus heat over the entire surface of each subregion will be required in order to have the maximum utilization of the estuary's theoretical total heat assimilative capacity. It is stated that cooling waters from large and concentrated heat sources should be spread over as large an area as possible, without causing local disturbances to the ecology near the point of discharge. Analysis of various aspects: the Chesapeake Bay, cooling requirements of thermal power plants, heat assimilative capacity, physical aspects of thermal discharges, biological and ecological considerations are given in the present paper. (Herrera-Vanderbilt)
W71-03479

REMOVAL OF PHOSPHATES BY SORPTION ON ACTIVATED ALUMINA,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 05D.
W71-03518

RELATIONSHIP OF AGRICULTURE TO SOIL AND WATER POLLUTION.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05B.
W71-03542

POLLUTION FACTORS ASSOCIATED WITH EXCESSIVE POULTRY LITTER (MANURE) APPLICATION IN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
Leslie H. Hileman.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 41-47. 9 tab, 1 fig, 5 ref.

Descriptors: *Farm wastes, *Poultry, Water pollution, Soil contamination, Rates of application, Soil tests, Phosphorus, Potassium magnesium, Salts, Ions, Nitrates.
Identifiers: *Poultry litter, Mono-valent ions, Di-valent ions.

There is an estimated one million tons of poultry manure or manure plus litter produced from 390.. million chickens and turkeys grown in Arkansas annually. The waste manure-litter is being returned to the soil often at rates exceeding 10 tons per acre annually. The data presented indicates that soil pollution and related problems may occur. These problems can be considered as: (1) excess soluble salt, (2) chemical imbalance with particular reference to K and the mono-valent to di-valent ratio, (3) excessive nitrate production and accumulation to toxic levels in forage and farm water supplies, and (4) forages deficient in magnesium for adequate animal nutrition. Further studies are needed to understand the mechanisms by which these conditions are carried out in the soil medium so that effective measures can be taken to prevent soil and water pollution. (See also W71-03542) (White-Iowa State)
W71-03544

INTRODUCTION,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
For primary bibliographic entry see Field 05A.
W71-03556

THE MENACE OF NOXIOUS GASES IN ANIMAL UNITS,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
E. Paul Taigonides, and Richard K. White.
Transactions of the ASAE, Vol 12, No 3, 1969, p 359-362, 367. 2 tab, 18 ref.

Descriptors: *Farm wastes, *Gases, *Effects, Carbon dioxide, Oxygen, Ammonia, Hydrogen sulfide, Methane, Lethal limit, Toxicity, Cattle, Hogs, Poultry, Ventilation, Treatment.
Identifiers: *Concentrations, Storage pits, Pit cleaning, Lethal situations.

The paper begins with a description of noxious gases and it is noted that animal deaths have occurred as the result of an accumulation of these gases. The gases, their properties and characteristics listed, are carbon dioxide, ammonia, hydrogen sulfide, methane, and other gases. Oxygen is listed to show its indispensability inside a confinement building. Animal response to menacing concentrations of these gases is described. A table lists different properties of the noxious gases and their physiological effects on the animals. Possibly fatal concentrations are noted, along with

the potentially lethal situations which may bring about these concentrations. Among these situations are ventilation breakdowns, pit stirring and pit cleaning. Finally, the control of noxious gases is emphasized. Preventive measures, moderating the effects of noxious gases, and treatment of affected animals are all discussed. (White-Iowa State)
W71-03574

DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT VOLUME I TEST-CASE STUDIES,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
For primary bibliographic entry see Field 05A.
W71-03770

DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT. VOLUME II. THE OVERVIEW SYSTEM,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
For primary bibliographic entry see Field 05A.
W71-03771

5D. Waste Treatment Processes

MICROBIOLOGY OF SEWAGE LAGOONS-ROLE OF PURPLE SULFUR BACTERIA IN STABILIZATION OF INDUSTRIAL WASTES,
North Dakota Water Resources Research Inst., Fargo.
John W. Vennes.
Available from NTIS as PB-196 656, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report WI-221-010-70, July 1965-Dec 1967, April, 1970. 16 p, 8 tab, 29 ref. OWRR Project A-003-NDAK (1).

Descriptors: Microbiology, *Sewage lagoon, Coliforms, Enteric bacteria, Biochemical oxygen demand, Temperature, Hydrogen ion concentration, Sulfides, *Sulfur bacteria, Sulfates, *Bacteria, Industrial wastes, *Oxidation ponds, Stabilization, Microorganisms.
Identifiers: Purple sulfur bacteria, Algal populations.

Ecologic relationships among various lagoon organisms and chemical and physical parameters of the lagoon were attempted. Pure cultures of the purple sulfur bacteria, Chromatium vinosum and Thiocapsa floridana were characterized with respect to optimum pH, temperature, and a variety of organic substrates. Purple sulfur bacteria reached maximal populations in the lagoon during the summer months when levels of acetic, butyric, and propionic acids were being depleted. Sulfide apparently was being liberated from sulfate by sulfate reducing bacteria. Methane bacteria reached their peak after sulfide disappeared from the lagoon and while formate utilization was reaching its maximal amount. Coliform, fecal coliform, and enterococci did not increase in the lagoon during the summer months. Algal populations remained minimal during the purple sulfur stage and increased approximately one log thereafter. Experimental and actual lagoon substrate determinations suggest that the purple sulfur bacteria are predominantly responsible for the utilization of volatile fatty acids from the lagoon. Furthermore, the majority of the BOD in the lagoon may be attributed to these volatile acids. A variety of microbial and chemical determinations were made. (See also W70-03312)
W71-03301

COAGULATION TESTING: A COMPARISON OF TECHNIQUES,
Wisconsin Univ., Madison. Water Resources Center
Rudy J. Te Kippe, and Robert K. Ham.
Available from NTIS as PB-196 666, $3.00 in paper copy, $0.95 in microfiche. Water Resources Center, University of Wisconsin, Madison, Wisconsin 53706, 1970. 58 p, 17 fig, 1 tab, 38 ref. OWRR Project A-028-WIS (2).

Descriptors: *Coagulation, *Turbidity, *Colloids, *Waste water treatment, Laboratory tests, Alum, Filtration, Hydrogen ion concentration.
Identifiers: Residual turbidity, Filtered turbidity, *Refiltration, Colloid titration, Sensitivity.

The literature indicates that over twenty different tests have been used for the purpose of evaluating the coagulation of turbidity in water treatment. Five of these tests were selected for study as they were felt to be basic and/or particularly important. These include: residual turbidity, filtered turbidity, refiltration, colloid titration, and a continuous pilot scale filter process. The five methods were compared holding all variables other than pH and alum dose constant. While some tests were shown to strongly correlate with others, the results of the refiltration technique were found to be biased in favor of low alum concentrations, and the colloid titration test was found to lack sensitivity with respect to variations in alum dosage but was quite sensitive to pH changes. The practical implications of this study suggest that water treatment plants should follow guidelines given for choosing the most useful test for their process. (See also W71-03313)
W71-03312

COAGULATION TESTING: A COMPARISON OF TECHNIQUES, PARTS I AND II,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Rudy J. Te Kippe, and Robert K. Ham.
Journal of the American Water Works Association, Vol 62, No 9, p 594-602, Sept 1970; Vol 62, No 10, p 620-628, October 1970. OWRR Project A-028-WIS (1).

Descriptors: *Coagulation, *Turbidity, *Colloids, *Waste water treatment, Laboratory tests, Alum, Filtration, Hydrogen ion concentration.
Identifiers: Residual turbidity, Filtered turbidity, *Refiltration, Colloid titration, Sensitivity.

Coagulation to remove particulate matter from turbid waters may be carried out by any of several techniques. This report attempts to discover which coagulation techniques yield comparable results, and which of these is preferable from the operator's standpoint. (See also W71-03312)
W71-03313

EFFECT OF SODIUM CHLORIDE AND SODIUM SULFATE ON SLUDGE DIGESTION,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
Robert S. Ingols, Richard E. Robert, Jr., Ekkehard Gasper, and Popet Vira.
Available from NTIS as PB-196 732, $3.00 in paper copy, $0.95 in microfiche. Final Report to Federal Quality Administration, Project B-338, September 1970. 40 p, 5 tab, 13 fig, 7 ref. FWQA Program 17070 DYF -- 09/70.

Descriptors: Waste water treatment, *Sludge treatment, *Sludge digestion, *Biodegradable detergents, *Sodium sulfate, *Sodium chloride, Ion exchange, Textiles, Microorganisms, Ions, Aerobic treatment, Foaming, Flocculation.
Identifiers: Industrial waste treatment, Sulfide ion effects, *Textile mill wastes.

High concentrations of sodium chloride and sodium sulfate have been observed in a town with a high concentration of textile mills. Sludge digestion was very poor. A toxic synergism between sodium chloride and sodium sulfate (sulfide) was hypothecated. Data indicated a marked reduction in gas production through a bi-sulfide ion effect upon the first stage microorganisms. The methane organisms appeared to starve rather than suffer a toxic effect from an accumulation of first stage by-products. Inert salt concentration had very little effect. Biodegradable synthetic detergents now used in place of salt to cause dye uptake require long periods of aerobic treatment because of interference by foam in floc development.
W71-03452

DEVELOPMENT OF A PORTABLE PILOT PLANT TO DEMONSTRATE REMOVAL OF CARBONACEOUS, NITROGENOUS, AND PHOSPHORUS MATERIALS FROM ANAEROBIC DIGESTER SUPERNATANT AND SIMILAR PROCESS STREAMS,
FMC Corp., Santa Clara, Calif. Central Engineering Labs.
George E. Bennett.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. I67, 13/4; 17010 FKA-05/70 paper copy $1.00. Also available from NTIS as PB-196 733, $0.95 in microfiche. Water Pollution Control Research Series ORD-17010 FKA 05/70, May 1970. 73 p, 16 tab, 15 fig, 4 ref, append. FWQA Program 17010 FKA -- 05/70, Contract No. 14-12-414.

Descriptors: *Waste water treatment, Sludge treatment, Nutrients, Nitrogen compounds, Phosphorus compounds, *Anaerobic digestion, Digestion.
Identifiers: *Phosphorus Removal, *Nitrogen Removal, *Nutrient removal, Ammonia stripping, *Digester supernatant, Lime precipitation.

Digester supernatant contains high concentrations of nitrogen and phosphorus, also, poor quality supernatant discharged from an anaerobic digester can have an adverse effect on the overall efficiency of a waste water treatment plant. FMC Corporation undertook to build and demonstrate the operation of a unique, trailer-mounted, and completely self-contained pilot plant. The pilot plant is designed to investigate the improvement of digester supernatant quality, with particular emphasis on the removal of nitrogen and phosphorus. The pilot plant treatment sequence consists of carbon dioxide removal via air-stripping, lime precipitation of phosphorus and carbonaceous particulate matter, and removal of nitrogen by packed-tower ammonia-stripping. The pilot plant was operated over a two-month period at a trickling filter plant where two-stage anaerobic digestion is practiced. The pilot plant operated in a reliable and consistent fashion with respect to both the mechanical performance and the process data obtained. A wide range of operating conditions was investigated in a convenient and effective manner. It was found that 80-95% of supernatant phosphorus could be removed at a lime dosage equal to 50 pounds of hydrated lime per pound of phosphorus removed. Average ammonia-nitrogen removal was 82%, achieved at an air flow rate equal to 83,000 cubic feet of air per pound of NH3-N removed. Normal lime precipitation removed about one-half of the supernatant TOC, COD, and Organic Nitrogen. The average decrease in suspended solids was 64%.
W71-03453

PHOSPHORUS REMOVAL USING CHEMICAL COAGULATION AND A CONTINUOUS COUNTERCURRENT FILTRATION PROCESS,
Johns-Manville Research and Engineering Center, Manville, N. J.
G. R. Bell, D. V. Libby, and D. T. Lordi.
Available from NTIS as PB-196 734, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series 17010 EDO -- 06/70, June 1970. 58 p, 11 tab, 9 fig, 7 ref. FWQA Program 17010 EDO, Contract 14-12-154.

Descriptors: *Phosphates, *Waste water treatment, Electrolytes, Effluents, *Filtration, *Trickling filters, Municipal wastes, Sewage effluents, Sludge disposal, Biochemical oxygen demand.
Identifiers: *Phosphorous removal, Orthophosphates, Alum.

he Johns-Manville Moving Bed Filter, a continu-
us precipitation and countercurrent filtration
rocess, was evaluated for the removal of
iosphorus from municipal wastewater. Using
um and an anionic polyelectrolyte, the process
as found to effectively reduce total phosphorus
P), orthophosphate (OP) and condensed
iosphate (CP) over a wide range of influent
iosphorus concentrations. Preliminary work
ing jar tests established an alum dose of 200 mg/l
7.4 mg/l Al, molar ratio of Al/P is 27/31) as ef-
ctive for removal of 90 percent TP from the
condary clarifier effluent of a trickling filter
ant. This removal efficiency could not be
stained with an alum dose of 200 mg/l when
gher TP levels were encountered. With total
iosphorus concentrations on the order of 25 to 28
g/l as P (Al/P — 0.6-0.7), the TP removal effi-
ency averaged 90 per cent. With lower total
iosphorus concentrations, removal efficiency
eraged 95 per cent and ranged up to 99 per cent
l/P — 1.2-2.6). Substantial reductions in final ef-
ient total suspended solids (TSS) and 5-day
ochemical oxygen demand (BOD5) were also ob-
ined. At an alum dose of 200 mg/l, TSS reduction
eraged 70 per cent and BOD5 reduction 80 per
nt. If phosphorus removal were not a design con-
leration, the reduction of TSS and BOD5 could
achieved with lower alum doses. The 200 mg/l
um dose was also found to be equally effective for
moval of phosphorus from raw sewage and pri-
ary effluent with the added capability for remov-
g substantial portions of the TSS and BOD5. In
ort studies on these streams, effluent as good or
tter than the final effluent from the trickling
ant was obtained. Costs for a 1.0 MGD plant are
timated to be $264,000 for capital and 12.0 cents
r 1000 gal for total operating cost. These costs
ould be about the same for raw sewage, final ef-
ient or the two intermediate levels of prior treat-
ent studied. Ultimate disposal of the phosphorus-
ntaining sludge could be achieved by a dewater-
g and landfill operation. Dewatering by means of
rotary vacuum precoat filter would require an
timated capital expenditure of $30,000 and total
st would be 3 cents per 1000 gal of original waste
ater treated.
71-03454

**ASIC SALINOGEN ION-EXCHANGE RESINS
OR SELECTIVE NITRATE REMOVAL FROM
OTABLE AND EFFLUENT WATERS,**
rco Labs., Inc., Waltham, Mass.
L. Walitt, and H. L. Jones.
r sale by the Superintendent of Documents, U. S.
overnment Printing Office, Washington, D. C.
402. Price $1.00. I67, 13/4:17010 FKF 12/69
per copy $1.00. Available from NTIS as PB-196
5, $0.95 in microfiche. Water Pollution Control
esearch Series, ORD 17010 FKF 12/69. Ad-
nced Waste Treatment Research Laboratory,
ncinnati, Ohio, December 1969. 88 p, 17 tab, 10
, 28 ref, 2 append.

escriptors: *Ion exchange, *Waste water treat-
ent, *Resins, Ions, Nitrates, Chlorides.
entifiers: *Nitrate ions, *Nitrate removal, Resin
nthesis, Weak-base resins, Resin regeneration,
n selectivity, Ion capacity, Styrenes, Chloride
n.

eparation of nitrate-specific ion-exchange resins,
hich incorporate selected primary amines grafted
to polystyrene, has been investigated. The best
lectivity for nitrate ion over chloride ions was ob-
ned with the 1-naphthylmethl-aminomethyl
rivative of polystyrene (1-NMA resin). Nitrate
s adsorbed quantitatively from feed solutions
ntaining five times as much chloride ion as
trate ion. Under identical conditions, commercial
eak-base resins removed only 70% of the nitrate
n. The 1-NMA resin could be regenerated re-
atedly in the chloride form by HCl, but attempts
alkaline regeneration led to irreproducible
sults. Recommendations for future work include
vestigation of the effects of cross-linking, addi-
n of hydrophilic functional groups, quaterniza-
n of the amine, and incorporation of different,
trate-selective, functional groups.

W71-03455

KINETICS AND MECHANISM OF PRECIPITATION AND NATURE OF THE PRECIPITATE OBTAINED IN PHOSPHATE REMOVAL FROM WASTE WATER USING ALUMINUM (III) AND IRON (III) SALTS,
Atomics International, Canoga Park, Calif.
Harold L. Recht, and Masood Ghassemi.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $0.75. I67, 13/4; 17010 EKI 04/70 paper copy $0.75. Available from NTIS as PB-196 737, $0.95 in microfiche. Water Pollution Control Research Series 17010 EKI-04/70, Advanced Waste Treatment Research Laboratory, Cincinnati, Ohio, April 1970. 77 p, 29 fig, 4 tab, 9 ref. FWQA Program 17010 EKI, Contract 14-12-158.

Descriptors: *Phosphates, *Kinetics, Aluminum, Iron, *Waste water treatment, *Chemical precipitation, *Effluents, Chemical reactions.
Identifiers: *Phosphate removal, Aluminum salts, Iron salts, Orthophosphates, Secondary effluents.

An investigation was conducted of the rate, mechanism and stoichiometry of phosphate precipitation with aluminum and ferric salts from pure phosphate solutions and secondary effluent. These studies showed that the reactions of orthophosphate ion with both Al (III) and Fe (III) are completed in less than 1 second. The effects of pH, reactant concentration, and reagent aging on the efficiency of phosphate removal were evaluated in batch precipitation experiments. The pH of optimum athophosphate precipitation was found to be close to 6.0 for Al (III) and in the vicinity of 3.5 to 4.0 for Fe (III). With an initial orthophosphate concentration of 12 mg/l P, maximum phosphate removal was about 82% with Fe (III) and about 78% with Al (III) at a 1:1 molar ratio increasing to over 99% for both cations at a 2:1 ratio. At constant pH, with both Fe (III) and Al (III) up to about a 1:1 molar ratio, orthophosphate removal was directly proportional to amount of added cation, indicating occurrence of a chemical reaction. Dilute solutions of Fe (III) were found to undergo extensive hydrolysis on aging with a resultant loss of capacity to precipitate phosphate. The removal of condensed phosphates by precipitation with aluminum and iron salts was found to be strongly dependent on pH and the reactant concentration ratio. Precipitates obtained in the reaction of orthophosphate with aluminum and ferric salts were examined by X-ray diffraction analysis after drying and heating to 104C and to 600C. Both precipates remained amorphous, except that ferric phosphate was identified after ignition at 600C. (Selby-Texas)
W71-03457

PHOSPHATE REMOVAL FROM WASTE WATERS USING LANTHANUM PRECIPITATION,
Atomics International, Canoga Park, Calif.
Harold L. Recht, and Masood Ghassemi.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. I67, 13/14; 17010 EFX 04/70 paper copy $0.75. Available the NTIS as PB-196 738, $0.95 in microfiche. Water Pollution Control Research Series 17010 EFX: 04/70, Advanced Waste Treatment Research Laboratory, Cincinnati, Ohio, April 1970. 45 p, 18 fig, 1 tab, 11 ref. FWQA Program 17010 EFX, Contract 14-12-183.

Descriptors: *Phosphates, *Waste water treatment, Turbidity, Aluminum, Hydrogen ion concentration, *Effluents, Chemical precipitation.
Identifiers: Phosphate removal, Secondary effluent, *Lanthanum, *Orthophosphates.

A parametric study was made of the removal of ortho- and polyphosphates from pure solutions and secondary effluent with La (III), and the results compared with those from similar tests with Al (III). The reactions of orthophosphate with both La (III) and Al (III), resulting in precipitate formation and phosphate removal, were complete in less than 1 sec. La (III) showed a broader effective pH range and lower residual phosphate concentration and thus proved to be far superior to Al (III) for phosphate, especially polyphosphate, precipitation. Within the pH range for optimal phosphate removal, the La (III)-phosphate reactions produced large, settleable flocs. Immediately outside this range, poorly settling fine turbidity developed. At pH levels above this region, some residual turbidity was generally observed. No turbidity or precipitation was observed at very low pH levels. At constant pH, orthophosphate removal was directly proportional to the La (III) PO4-3 molar ratio, with complete removal at a ratio of approximately 0.9. This strongly suggests that orthophosphate removal with La (III) occurs solely through a chemical reaction and not through an adsorption process. With secondary effluent, as with pure solutions, lower residual phosphate resulted over a wider pH range with La (III) than with Al (III); no pH adjustment is needed for effective removal with La (III), while considerable amounts of acid or excess Al (III) are required to achieve the optimum pH of 6 for phosphate removal. (Selby-Texas)
W71-03458

ULTIMATE DISPOSAL OF PHOSPHATE FROM WASTE WATER BY RECOVERY AS FERTILIZER,
Grace (W. R.) and Co., Clarksville, Md.
Maria G. Dunseth, Murial L. Salutsky, Kenneth M. Ries, and Joseph j. Shapiro.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.70. I67, 13/14; 170170 ESJ 01/70 paper copy $0.70. Availabile from NTIS as PB-196 739, $0.95 in microfiche. Water Pollution Control Research Series 17070 ESJ-01/70, Advanced Waste Treatment Research Laboratory, Cincinnati, Ohio, January 1970. 74 p, 24 tab, 18 fig, 13 ref. FWQA Program 17010 ESJ, Contract 14-12-171.

Descriptors: *Phosphates, *Waste water treatment, Fertilizers, Biochemical oxygen demand, Chemical oxygen demand, Effluents, Sewage effluents, *Water reuse.
Identifiers: Digester supernatant, *Orthophosphates.

Many of the proposed processes that reduce orthophosphate in the effluents from sewage treatment plants result in the extracted phosphate being concentrated in the digester supernatant. This phosphate must be removed prior to disposal of the supernatant or its recycle back to the head of the treatment plant. Digester supernatant was treated in two ways. The first was to add magnesia and elevate the pH to 9 to cause precipitation of the phosphorus. The other technique was to apply heat and/or vacuum to the digester supernatant which caused precipitation of the soluble orthophosphate. A 90% removal of orthophosphate can be achieved by either approach. The heat and/or vacuum process also yields a supernatant substantially lower in BOD, COD, and nitrogen concentration. The precipitated phosphorous (primarily a mixture of calcium phosphate and magnesium ammonium phosphate) was found available for plant food according to AOAC (i.e., Association of Official Agricultural Chemists) procedures. Work was conducted by bench and pilot plant studies on digester supernatant from the Lake Zurich, Illinois sewage treatment plant and from the Libertyville, Illinois sewage treatment plant. (Selby-Texas0
W71-03459

INTERNAL HYDRAULICS OF THERMAL DISCHARGE DIFFUSERS, A DISCUSSION,
Camp, Dresser and McKee, Boston, Mass.
Thomas R. Camp, and David S. Graber.
Journal of the Hydraulics Division, Proceedings of the ASCE, Vol No HY12, December 1970, p 2631-2637. 4 fig, 1 tab, 4 ref.

Descriptors: *Diffusion, *Hydraulics, *Pipe flow, *Discharge coefficients, Thermal pollution, Reynolds number, Model studies.
Identifiers: *Friction factor, Diffusers, Spacing ratios.

An article about planning and design of outfalls for mixing both waste water effluents and cooling water with fresh water streams is discussed in this paper. It is said that the authors of the original article have presented a much simpler alternative computational procedure for the design of such dispersion conduits, based on an analysis in which the lateral outflow and head losses are assumed to be distributed continuously along the length of the conduit. It is also assumed that the flow is uniformly decreasing along the length of the diffuser and the friction factor is constant. It is concluded that: the method studied provides a convenient means for the preliminary design of fresh water diffusers and for final evaluation of proposed designs. For major diffuser structures particularly, for configurations saving a nonconstant value of C', which is a discharge coefficient, the procedure would be essential for final evaluation. If the diffuser is to be used for varying flow conditions, m, the selected design ratio of discharge at the latter outlet to the discharge at the former outlet will change with discharge to a degree depending upon the change in f and C'. The accuracy required depends, on the accuracy to which m must be predicted, at being noted that m is relatively insensitive to changes in head loss if 1-m is small. (Herrera-Venderbilt)
W71-03461

HEATED SURFACE JET DISCHARGED INTO A FLOWING AMBIENT STREAM,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W71-03478

ELECTRODIALYSIS IN ADVANCED WASTE TREATMENT,
Ionics, Inc., Cambridge, Mass.
J. D. Smith, and J. L. Eisenmann.
Available from NTIS as PB-174 925, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series WP-20-AWTR-18, Federal Water Pollution Control Administration, Robert A Taft Sanitary Engineering Center, Feb 1967. 219 p, 32 fig, 33 tab, 19 ref. FWPCA Project 17040---02/67.

Descriptors: *Electrodialysis, *Economics, Demineralization, Membranes, Scaling, Design, *Waste water treatment.
Identifiers: Deonization, Anion membranes.

To determine the practicality of partially demineralizing municipal waste water by electrodialysis, a bench-scale experiment was made, using filtration alone and filtration followed by carbon adsorption as pretreatments. Long-term runs were made with a muncipal secondary effluent to determine scaling and fouling effects of the water upon the electrodialysis membranes. A study was made during these runs to determine how high a ratio of product rate to concentrate rate could be obtained without forming scale on the membranes. Some fouling of anion membranes occurred with filtration and carbon adsorption pretreatment; without carbon adsorption, fouling was much worse. Scale formation was not a problem at product to concentrate ratios less than ten. At times much higher ratios were obtained without difficulty. The results of these runs indicated that the total operating cost for a 10-mgd electrodialysis treatment plant might be less than $.10 per 1,000 gal. (Selby-Texas)
W71-03503

ELECTROCHEMICAL TREATMENT OF MUNICIPAL WASTE WATER,
Pennsalt Chemicals Corp., Philadelphia, Pa.
H. C. Miller, and W. Knipe.
Available from NTIS as PB-168 794, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-13, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Sanitary Engineering Center, March 1965. 58 p, 14 tab, 6 fig, 15 ref. FWPCA Project 17020---03/65.

Descriptors: *Waste water treatment, *Electrochemistry, *Economics, Chemical oxygen demand, Activated sludge, Chlorides, Electrodes, Anodes, Alkylbenzene sulfonates, Municipal water.
Identifiers: Lead, Lead-silver alloys, Lead dioxide, Municipal waste water.

The effectiveness of electrolytic methods of treating waste water is in doubt. This study shows that an electrolytic treatment of secondary effluent from an activated-sludge plant using lead dioxide anodes can reduce ABS by 90%, COD by 80%, and chloride by 90%. This treatment has little effect on total solids. The cost of treatment will vary between $0.90 and $2.42 per 1,000 gallons. The plant costs will vary between $9 million and $26 million for a 10 mgd plant. The method is not considered economically practical for waste water renovation, wherein waters of relatively low conductivity must be processed. The authors also conclude that the work by the Lead Industries Association on the use of lead and lead-silver alloys in the treatment of waste waters should be followed since the results may have application in treating waste waters of relatively high conductivity. (Selby-Texas)
W71-03504

ADSORPTION OF BIOCHEMICALLY RESISTANT MATERIALS FROM SOLUTION 1,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
J. C. Morris, and W. J. Weber, Jr.
Available from NTIS as PB-168 799, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-9, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Sanitary Engineering Center, May 1964. 74 p, 40 fig, 7 tab, 16 ref. FWPCA Project 17020---05/64.

Descriptors: *Waste water treatment, *Adsorption, Activated carbon, Kinetics, Equilibrium.
Identifiers: Advanced waste treatment, Refractory materials.

The report is primarily a summary of research progress rather than a complete description of how adsorption may be used to optimum advantage. The studies on the kinetics of adsorption on granular carbon showed that: (1) Uptake from dilute solution proceeds slowly for compounds of high molecular weight, (2) The rate of adsorption is a linear function of the square root of concentration. This implies that the process favor removal of trace quantities, (3) Rates of adsorption decrease considerably with increasing size of adsorbate when the amount adsorbed per unit is expressed in molar units; when expressed in weight units, the effect is much less pronounced, (4) The configuration of the adsorbate molecule affects rate of uptake; molecules with highly branched structures are removed much more slowly than those of identical molecular weight but with a configuration that permits coiling or attainment of compactness, (5) Rates of adsorption per unit weight of carbon vary reciprocally as the square of the diameter of individual carbon particles, (6) The rate of adsorption of alkylbenzenesulfonates increases with decreasing pH of the solution. The findings correlate with equations derived for infraparticle diffusion, which indicates that the rate of adsorption is controlled by rate of diffusion of solute within the micropores of the carbon. Extension of this research, currently underway, should provide supplementary information that will be of considerable use in the final design of appropriate adsorption processes. (Selby-Texas)
W71-03505

ADSORPTION OF BIOCHEMICALLY RESISTANT MATERIALS FROM SOLUTION 2,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
J. C. Morris, and W. J. Weber.
Available from NTIS as PB-170 700, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-16, Advanced Waste Treatment Program, Federal Water Pollution Control Administration, Robert A Taft Sanitary Engineering Center, March 1966. 108 p, 77 fig, 13 tab, 37 ref, 2 app. FWPCA Project 17020---03/66.

Descriptors: *Adsorption, *Activated carbon, Waste water treatment, Equilibrium, Kinetics, Pesticides.
Identifiers: Refractory materials, Regeneration, Advanced waste treatment.

As reported in PHS Publication No 999-WP-11-AWTR-9, earlier studies showed that activated carbon for waste water renovation could best be used in continuous-flow columns. Such techniques should result in an adsorptive capacity of greater than 10%. Results on studies of adsorption of organics from single-and multi-component systems in fluidized carbon are reported in these publications. The adsorbability of organic pesticides on activated carbon was investigated in some detail. Studies were undertaken to characterize those types of organic pollutants that are not adsorbed on activated carbon. The report concludes that if additional removal of organic matter beyond that now obtainable with reasonable depth of activated carbon is desired, one should follow the activated carbon with a contrasting type of adsorbent. (Selby-Texas)
W71-03506

FEASIBILITY OF GRANULAR ACTIVATED CARBON ADSORPTION FOR WASTE-WATER RENOVATION,
Pittsburgh Chemical Co., Pa.
R. S. Joyce, and V. A. Sukenik.
Available from NTIS as PB-169 383, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-18, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Sanitary Engineering Center, Oct 1965. 38 p, 17 fig, 10 tab, 2 ref. FWPCA Project 17020---10/65.

Descriptors: *Waste water treatment, *Activated carbon, *Adsorption, Flocculation, Chemical oxygen demand, Effluents, Sludge.

In the first interim report (AWTR-10, PHS Publication No. 999-WP-12) it was shown that treatment of secondary waste water effluent from an activated-sludge process with granular, activated carbon in a column process reduced COD content to concentrations between 12 and 20 ppm. ABS removal was essentially complete. The current study was initiated to determine if an increased contact time in the carbon bed, effected by a reduction in flow rate, would improve the degree of COD removal. In the study, granular activated carbon in packed-bed column contractors 20 feet deep and operated at a flow rate of 4 gpm per square foot reduced the COD to an average value of 18.5 ppm. This was not significantly different from removal obtained at a 10 gpm per square foot operating level. Typical adsorption isotherms for type SGL carbon for COD indicated capacities of approximately 35% by weight. Cyclic saturation and regeneration of activated carbon through 16 cycles had an average carbon loss of 4.6% of secondary effluent prior to carbon adsorption increased the adsorption capacity of carbon and resulted in much lower final levels of COD than the levels obtained with unflocculated effluent. (Selby-Texas)
W71-03507

EVALUATION OF VARIOUS ADSORBENTS AND COAGULANTS FOR WASTE WATER RENOVATION,
Ionac Chemical Co., Birmingham, N.J.
J. N. Williamson, A. H. Heit, and C. Calmon.

Available from NTIS as PB-170 741, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-12, Advanced Waste Treatment Research Program, Robert A Taft Sanitary Engineering Center, Public Health Service, June 1964. 91 p, 20 tab, 9 fig, 10 ref, append. FWPCA Project 17020---06/64.

Descriptors: *Waste water treatment, Proteins, Anion exchange, Coagulation, Economics, Adsorption.
Identifiers: Minerals, Sludge blanket.

Certain inexpensive, commercially available materials were investigated to see if they hold promise in treatment of waste waters, especially secondary effluents. Activated carbon was used as a reference. Minerals treated with salts of tetravalent metals show promise for the organic-solute phase of secondary waste water effluents. Most conventional coagulants exhibit marked affinities for the refractory organic materials in these secondary effluent. Proteins show similar properties when coagulated in the presence of mineral acids and certain acid salts of trivalent metals. Hydrophobic proteins, aldehyde hardened in granular shape then further reacted with acids or acid salts, will also remove organic refractory contaminants from secondary effluents. Organic anion exchangers will also remove organic solutes from waste water. The problem of irreversible organic fouling requires more attention if exchangers are to be considered. Precoagulation of the higher molecular species of organics is suggested as a fouling preventive measure. This study demonstrated the mechanical feasibility of incorporating solid adsorbents into the sludge blanket process for water treatment in the presence or absence of coagulants. The sludge blanket process can combine the virtues of finely divided, large surface area forms of solids and flocs with the maintenance of relatively high flow rates, normally associated with columnar-bed techniques. Material cost factors are discussed for the various materials tested and for the treatments involving their use. Recommendations are made for possible further lines of investigation. (Selby-Texas)
W71-03508

ADVANCED WASTE TREATMENT BY DISTILLATION,
Badger (W. L.) Associates, Inc., Ann Arbor, Mich.
J. H. Neale.
Available from NTIS as PB-168 839, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-7, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Engineering Center, March 1964. 55 p, 8 fig, 12 tab, 4 ref. FWPCA Project 17080---03/64.

Descriptors: *Waste water treatment, *Distillation, Evaporation, Economics, *Scaling, *Corrosion.
Identifiers: *Advanced waste treatment.

In a desk-top study of scaling and corrosion effects, a municipal water re-use cycle was assumed in which sufficient waste water distillate would be mixed with waste water treated for organic contaminant removal only to give a mixture suitable for the municipal water supply. The study shows that the concentration of scaling materials is small enough that, in many cases, distillation at a temperature of 400F should be possible. An economic advantage over sea-water distillation would be expected. Potential corrosion problems exist. Continuous boiling experiments were carried out on Ann Arbor sewage to determine the fouling effects of organic contaminants. Distillation of secondary effluent at temperatures up to 250F should not result in fouling. Operation with primary effluent does not appear feasible without additional treatment for removal of suspended materials. The study concluded that (1) distillation appears to be practical and economically attractive, (2) a system combining distillation and adsorption could be used to produce water for direct reuse, (3) pretreatment required for scale control prior to distillation will vary, (4) cost of waste water renovation by distillation will be less than the cost of sea-water conversion, (5) distillation should be used in parallel with another, less expensive operation such as adsorption to achieve the lowest cost of product water, and (6) study of the application of distillation to advanced waste treatment should be continued, and a pilot study should be instituted. (Selby-Texas)
W71-03509

COST OF PURIFYING MUNICIPAL WASTE WATERS BY DISTILLATION,
Delaware Univ., Dover.
J. A. Gerster.
Available from NTIS as PB-168 978, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-6, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Sanitary Engineering Center, Nov 1963. 43 p, 10 tab, 6 fig, 36 ref. FWPCA Project 17080---11/63.

Descriptors: *Waste water treatment, *Distillation, *Costs, *Sea water, *Flash distillation, Municipal water.
Identifiers: Multi-stage flash equipment, Multiple-effect equipment, Recompression-flash equipment, Municipal waste water, Blowdown.

To estimate the cost of distillation of waste water, desk top studies were made with the types of equipment proposed for use with sea water. The estimates are based upon those for sea water, but are modified to conform with the differences in the modes of operation for the two feeds. The smaller concentration of scaling materials in waste water should allow distillation to be carried out at a higher temperature than can be used with sea water. The smaller total contaminant concentration results in a smaller boiling-point elevation. Because of the need to dispose of the blowdown permanently it is necessary to concentrate to a far greater extent than in the case of sea-water distillation. Three types of equipment--multi-stage flash, multiple-effect, and recompression flash--appear economically promising. For all types of equipment the cost for the distillation step alone is somewhat less than for sea water, but inclusion of costs for feed pretreatment and ultimate disposal of blowdown, bring the cost up to about that for sea water. (Selby-Texas)
W71-03510

CONTAMINANT REMOVAL FROM SEWAGE PLANT EFFLUENTS BY FOAMING,
Radiation Applications, Inc., Long Island City, N.Y.
E. Rubin, R. Everett, Jr., and J. J. Weinstock.
Available from NTIS as PB-168 797, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-5, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Engineering Center, Cincinnati, Ohio, December 1963. 56 p, 17 tab, 12 fig, 22 ref. FWPCA Project 17020---12/63.

Descriptors: *Waste water treatment, *Foaming, *Alkylbenzene sulfonates, Chemical oxygen demand, Sewage effluents, Detergents.
Identifiers: Volume reduction, Advanced waste treatment.

One of the refractory solutes present in most sewage plant effluents is the surface-active agent alkyl benzene sulfonate (ABS). The paper reports that ABS concentrations (based on methylene blue analysis) between 2.0 and 3.2 ppm in secondary effluent have been consistently reduced to between 0.3 and 0.5 ppm by use of air-to secondary effluent, volumetric-flow ratios between 7 and 3, correspondingly. A correlation has been demonstrated between residual ABS concentration and the volume of aeration air available per unit mass of ABS in secondary effluent. A 10 to 45% diminuation in COD was observed after foaming. Volume reductions in continuous equipment averaged about 125, and values up to 1,000 have been obtained. Total dissolved solids and chloride ions have been found to be unaffected by the foaming process. An increase in pH upon foaming suggests that weakly acidic substances are being removed. (Selby-Texas)
W71-03511

PART 1. A DESIGN STUDY OF FREEZING AND GAS HYDRATE FORMATION. PART 2. FEASIBILITY TESTS OF FREEZING,
Syracuse Univ., N.Y.
A. J. Barduhn, A. Rose, and R. F. Sweeny.
Available from NTIS as PB-168 798, $3.00 in paper cipy, $0.95 in microfiche. Environmental Health Series AWTR-4, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Sanitary Engineering Center, October 1963. 45 p, 10 tab, 8 fig, 19 ref. FWPCA Project 17080---10/63.

Descriptors: *Waste water treatment, *Freezing, Economics, Pre-treatment (Water), Chemical oxygen demand, Alkyl benzene sulfonate, Sea water, Municipal waste.
Identifiers: *Advanced waste treatment, *Gas hydration.

In a preliminary design to renovate municipal waste waters, freezing and gas hydrate processes for demineralizing sea water are adapted. The author of part one, assuming a feed material containing 1,000 parts total dissolved solids per million, predicts costs for recovering 92% of the feed as potable water. The waste stream can be further concentrated under eutectic conditions to produce more water and a waste stream of damp solids. In part 2, during 14 actual freezing tests completed, chemical oxygen demand was reduced 65 to 85%; chlorides 85 to 90%; and conductivity, 90% or more. Reduction of alkyl benzene sulfonate was erratic. With data from the better test runs, preliminary cost estimates indicate that 95% of the feed water containing 10% of the contaminants can be recovered at a cost somewhat lower than that predicted for desalinating sea water by freezing. (Selby-Texas)
W71-03512

ULTIMATE DISPOSAL OF ADVANCED-TREATMENT WASTE, PART 1. INJECTION, PART 2. PLACEMENT IN UNDERGROUND CAVITIES, PART 3. SPREADING,
Louis Koenig-Research, San Antonio, Tex.
For primary bibliographic entry see Field 05E.
W71-03513

ULTIMATE DISPOSAL OF ADVANCED-TREATMENT WASTE, PART 1. WET OXIDATION, PART 2. INCINERATION,
Louis Koenig-Research, San Antonio, Tex.
For primary bibliographic entry see Field 05E.
W71-03514

SUMMARY REPORT, ADVANCED WASTE TREATMENT, JULY 1964-July 1967.
Federal Water Pollution Control Administration, Cincinnati, Ohio.

Available from NTIS as PB-179 515, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series WP-20-AWTR-19, Advanced Waste Treatment Branch Division of Research, Robert A Taft Engineering Center, 1968. 96 p, 17 tab, 36 fig, 24 ref, append. FWPCA Project 17000---07/68.

Descriptors: *Waste water treatment, Nutrients, Lime, Utlimate disposal, Activated carbon, Electrodialysis, Ion exchange, Reverse osmosis, Denitrification, Electrochemistry, Foaming, Solvent, Extractions, Distillation, Freezing.
Identifiers: *Advanced waste treatment, *Lime clarification, Suspended solids removal, Organic removal, Inorganic removal, Nutrient removal, Granular carbon, Powdered carbon, Air stripping.

The report summarizes results of advanced waste-treatment studies from July 1964 to July 1967. A wide range of waste water treatment processes have been evaluated under the program for technical and economic feasibility. These methods include processes for suspended solids removal, organic and inorganic removal, nutrient removal, and ultimate disposal of concentrated end products. A number of processes have been studied extensively enough to assess their feasibility to a fair degree of accuracy. For waste waters, with appropriate contaminant composition, lime clarification will effectively remove suspended solids and the nutrient phosphate and the economics are expected to be favorable. Alum clarification is expected to be a successful method at a cost of 8 cents/1,000 gal. or less for a 10-mgd plant. For organic removal, activated-carbon treatment is very promising. Granular-carbon treatment without clarification of the feed can be carried out for about 8 cents/1,000 gal. at the 10-mgd level. Powdered-carbon treatment should cost about 12 cents/1,000 gal. at the 10-mgd level, provided carbon can be reactivated, with process improvements probably reducing the costs. For removal of gross inorganic content, electrodialysis should be possible for about 16 cents/1,000 gal in a 10-mgd plant. Other inorganic removal processes such as ion exchange and reverse osmosis may be competitive with electrodialysis. An air-stripping process for ammonia appears technically feasible and should not cost over 2 cents/1,000 gal for a 10-mgd plant, excluding cost of adjustment of pH to 10 or above. Initial study of denitrification of a highly nitrified effluent or granular activated carbon shows promise for nitrate removal. Study of a number of processes given preliminary evaluation has been halted for the present because of certain unfavorable characteristics. These processes include electrochemical treatment, foaming, solvent extraction, distillation and freezing. (Selby-Texas)
W71-03515

SUMMARY REPORT-THE ADVANCES WASTE TREATMENT RESEARCH PROGRAM-JUNE 1960-DECEMBER 1961.
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

Available from NTIS as PB-174 923, $3.00 in paper copy, $0.95 in microfiche. Public Health Service, Robert A. Taft Sanitary Engineering Center, Summary Report, (June 1960-Dec 1961) ec TR, W62-9, May 1962. 65 p, 34 ref. FWPCA Project 17000-95/62.

Descriptors: *Waste water treatment, *Research and development, Economics.
Identifiers: Extramural and intramural research, Challenge, Organization and administration.

The first section discusses the containments of challenge; the second the economic challenge; the third the technical approaches being explored; the fourth the organization and administration of the program; and the fifth the present status of both extramural and intramural research efforts. (Selby-Texas)
W71-03516

REMOVAL OF PHOSPHATES BY SORPTION ON ACTIVATED ALUMINA,
Missouri Water Resources Research Center, Columbia.
Krishnier Purushothaman, and C. M. Yue.
Available from NTIS as PB-196 872, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, December 30, 1970. 79 p, 7 tab, 26 fig, 31 ref. OWRR Project A-029-MO (1).

Descriptors: *Phosphates, *Sorption, *Activated alumina, *Eutrophication, Tertiary treatment, Waste water treatment, Water pollution effects, Ions.
Identifiers: Alcoa alumina, *Freundlich equation, *Phosphorous removal, Ion removal.

The purpose of this investigation was to study the removal of phosphorus from waste water by sorption on activated alumina, and determine the capacity of the alumina to sorb phosphates in the presence of other ions, the effect of the influent flow rate and phosphorus concentration on the efficiency of the process, and the feasibility of regeneration of the used alumina. The studies were conducted using deionized and tap water to which inorganic phosphate had been added, and secondary effluent from bench-scale activated sludge units. They involved batch tests employing three types of activated alumina, ALCOA XM (minus 325 mesh), F-1 (minus 100 mesh), and F-1 (28-48 mesh), and continuous-flow tests carried out in three specially designed glass sorption columns using the F-1 (28-48) alumina. Activated alumina was found to have a greater capacity for removing phosphorus in the presence of hardness-causing ions, and each type of alumina had a different capacity for each test water used. The fraction of phosphorus removed by each alumina decreased when the initial phosphorus concentration in the test water increased. The influent flow rate inversely affected the phosphorus loading capacity of the alumina, and the used aluminas could be effectively regenerated with a 2M sodium hydroxide solution alone.
W71-03518

PAB PROCESS FOR ADVANCED WASTE TREATMENT,
Iowa State Univ., Ames. Engineering Research Institute.
Robert L. Johnson, and E. Robert Baumann.
Available from NTIS as PB-196 146, $3.00 in paper copy, $0.95 in microfiche. Iowa State Water Resources Research Institute, Completion Report, ISU-ERI-AMES-91100, ERI Project 756-S, December 1970. 42 p, 11 tab, 11 fig, 20 ref. OWRR Project A-025-IA (2).

Descriptors: *Adsorption, *Refractivity, *Tertiary treatment, *Waste water treatment, Effluents, Sewage effluents, Organic wastes.
Identifiers: Refractory organics, Pulsed adsorption bed, Total organic carbon, Biological metabolism, *Organic waste removal.

A NEW TERTIARY TREATMENT PROCESS HAS BEEN DEVELOPED UTILIZING THE PHYSICAL—CHEMICAL ADSORPTION OF SOLUBLE AND COLLOIDAL ORGANIC MATERIAL IN THE DILUTE FINAL EFFLUENTS OF SECONDARY BILOGICAL PROCESSES ONTO GRANULAR MEDIA. The refractory organic material thus concentrated can be utilized by microorganisms growing at the interface of the media in the psuedo-high concentration substrate. A significantly greater biological oxidation and synthesis of the residual organic material in the waste water is thus achieved and the interface is continuously regenerated. The waste water and air flow co-currently upward through a media bed. The air provides oxygen for biological activity and agitation of the media bed to prevent clogging. The rising air bubbles impact a periodic or pulsed motion to the media bed. Thus, the process was named the PULSED ADSORPTION BED (or PAB) PROCESS. The PAB process was developed first on a laboratory scale using synthetic sewage, and then with a pilot plant using trickling filter plant final effluent. Hydraulic loading rates of 125 and 220 MGAD were used in the laboratory and up to 100 MGAD in the field operation of the pilot plant. Corresponding organic loading rates were approximately 300 pounds BOD/1000 cubic feet/day. The PAB process coupled with solids separation units such as mixed media filters can provide 70 to 90 percent removal of the organic material in the final effluent from conventional complete treatment facilities. A combined solids treatment system could be designed, constructed and operated at a total annual cost of approximately 4 cents/1000 gallons.
W71-03519

MANPOWER SUPPLY IN WASTE WATER TREATMENT PLANTS,
Purdue Univ., Lafayette, Ind. Water Resources Research Inst.
L. N. Smith, and W. L. Miller.
Available from NTIS as PB-196 875, $3.00 in paper copy, $0.95 in microfiche. Purdue University Water Resources Research Center Technical Report No. 15, August 1970. 90 p, 1 fig, 15 tab, 22 ref. OWRR Project A-011-IND (1).

Descriptors: *Manpower, Employment opportunities, *Labor supply, Occupations, Resource allocations, *Waste water treatment, Wages.
Identifiers: Waste water treatment plant operators.

The research attempts to answer the question whether enough trained men will be available who are willing to work in the waste water treatment industry under present and projected economic conditions. The quantity of waste water treatment plant operators was postulated to be a function of wages, alternative wages, population, unemployment, and recent hirings. Simple equation, linear regression procedures based on cross sectional data, were used to estimate the operator supply functions. The analysis concludes that two variables appear to be significant in explaining the quantity of operators supplied, that is, wages and population. Projections for two regions in Indiana and for the State as a whole were made for 1972. The conclusions suggest managers have several alternatives to insure enough skilled and trained operators will be available. These alternatives include the change in wages and population variables suggested by the analysis of the supply function in this study and other techniques, such as, employing one operator full time to service a few small plants in the same geographic area or the training of additional operators. (Wiersma-Purdue)
W71-03521

MEMBRANE FOULING AND STUDIES ON NEW ELECTRODIALYSIS MEMBRANES,
Negev Inst. for Arid Zone Research, Beersheba (Israel).
For primary bibliographic entry see Field 03A.
W71-03522

REPORT ON WATER AND WASTE WATER FOR BROWARD COUNTY, FLORIDA.
Affiliates of Florida, Inc., Miami. Broward County Area Planning Board, Fort Lauderdale, Fla.

Available from NTIS as PB-195 039, $3.00 in paper copy, $0.95 in microfiche. Broward County Area Planning Board, Fort Lauderdale, Feb 1970. 256 p, 37 fig, 25 tab. HUD Project Fla P-85.
Identifiers: *Regional planning, *Florida, *Water resources, Regional planning, Water pollution, Sewers, Financial management, Waste water, Water treatment, *Broward County, Florida.

The report presents the recommendations resulting from a comprehensive water and waste water study. The study is addressed to existing conditions; adequacy of water and waste water facilities for present and future requirements; presentation of recommendations for future wholesale water and sewerage service, with attendant financing and administrative requirements.
W71-03532

HOUSE FLY PUPAE AS FOOD FOR POULTRY,
Agricultural Research Service, Beltsville, Md.
C. C. Calvert, R. D. Martin, and N. O. Morgan.
Journal of Economic Entomology, Vol 62, No 4, p 938-939, 1970. 2 tab, 2 ref.

Descriptors: *Poultry, Farm wastes, Feeds, Nutrients, Larvae, Waste treatment.
Identifiers: *House fly, Musca domestica L., Fly pupae.

Investigations were made to determine whether larvae or pupae of the house fly contained sufficient

nutrient value to use as feed for growing chicks. The results demonstrated that dried fly pupae provided enough protein of sufficient quality to support normal growth of chicks during the first two weeks of life. (Christenbury-Iowa State)
W71-03533

DANGEROUS GASES IN AGRICULTURE.
Ministry of Agriculture, Fisheries and Food, London (England).

Agriculture, Vol 77, No 9, p 431-432, September 1970.

Descriptors: *Gases, Farm wastes, Storage pits, Slurries, Accidents, Waste treatment.
Identifiers: Bacterial decomposition.

Gases from slurry pits can be dangerous to animals and concentrations fatal to man can occur. During storage and bacterial decomposition of the slurry causes a breakdown in organic matter and the release of gases. Recommendations are given that should help prevent accidents. (Christenbury-Iowa State)
W71-03534

FATTY ACID CONTENT AS A MEASURE OF THE ODOUR POTENTIAL OF STORED LIQUID POULTRY MANURE,
Guelph Univ. (Ontario). Dept. of Microbiology.
For primary bibliographic entry see Field 05A.
W71-03535

FLOW PROPERTIES OF ANIMAL WASTE SLURRIES,
Pennsylvania State Univ., University Park.
Mahesh Kumar, H. D. Bartlett, and N. N. Mohsenin.
Paper presented at the 1970 winter meeting American Society of Agricultural Engineers, Chicago, Dec 8-11, 1970, Paper No 70-911. 28 p, 7 fig, 2 tab, 26 ref.

Descriptors: *Slurries, *Viscosity, *Viscometers, Farm wastes, Viscous flow, Temperature, *Flow characteristics, Moisture content, Shear strength.
Identifiers: Shear diagrams, Flow behavior indices, Dilution, Pseudoplastic flow, Apparent viscosities, Newtonian fluids, Total solids.

The flow properties of animal waste slurries were studied with the use of a coaxial cylinder-type viscometer to determine shear diagrams, flow behavior indices, viscosity indices and apparent viscosities in relation to dilution, temperature and sawdust bedding content of the slurries. The viscosity of manure slurry decreases with increase in dilution. Flow is Newtonian for total solid content below five per cent. Addition of sawdust decreases the viscosity of slurries. Viscosity of fresh manure decreases with increase of temperature. Manure slurry of four to six percent total solids content is a good compromise between excessive volume of handling and power requirement. (Christenbury-Iowa State)
W71-03541

RELATIONSHIP OF AGRICULTURE TO SOIL AND WATER POLLUTION.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05B.
W71-03542

POLLUTION FACTORS ASSOCIATED WITH EXCESSIVE POULTRY LITTER (MANURE) APPLICATION IN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 05C.
W71-03544

REDUCING THE POLLUTION POTENTIAL OF LIVESTOCK WASTES WITH IN-THE-BUILDING OXIDATION DITCHES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
D. L. Day.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970. Ithaca, 1970, p 77-84. 11 fig, 3 ref.

Descriptors: *Farm wastes, Oxidation lagoon, Irrigation, Aeration, Biochemical oxygen demand, Odor, Aerobic treatment, Labor, Rotors, Denitrification, Coagulation, Effluent.
Identifiers: *Oxidation ditch, *Slotted floors, Aerator, Clarifier.

A low-odor, low-labor, system of managing livestock wastes from animal to field is discussed. The system consists of (1) a confinement building for livestock, with self-cleaning, slotted floors; (2) an oxidation ditch beneath the slotted floors; (3) a nonoverflow of mixed liquor from the oxidation ditch; and (4) irrigating equipment for removing surplus liquids and solids from the lagoon and distributing them on nearby land when convenient for the operator. This system greatly improves the quality of the waste water, but without further treatment the waste water would probably not meet quality criteria for the receiving water. Thus the main advantages of the system are: low labor, low odor, low stream-pollution potential, and operator convenience. (See also W71-03542) (White-Iowa State)
W71-03545

THE CONCEPTUAL DESIGN OF AN ECONOMICALLY FEASIBLE ANIMAL WASTE DISPOSAL SCHEME,
Resource Engineering Associates, Wilton, Conn.
R. W. Okey, and R. N. Rickles.
In: Relationship of Agriculture To Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 85-97. 11 tab, 4 fig, 11 ref.

Descriptors: *Farm wastes, *Cattle, *Biological treatment, Treatment facilities, Capital costs, Operating costs, Installation costs, Sludge, Centrifugation, Denitrification, Phosphorus, Nitrogen, Incineration, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: *Feedlot, Population equivalent, Waste management, Clarifer, Transport system.

Based on earlier work, a complete system for the capture, transport and treatment of the wastes from a 25,000 animal lot was presented. System capital costs are seen to be about $1.00 - $2.00/ton, and operating costs are around $3.00 - $4.00 per ton of wet waste. These costs result in a cost/lb gained of less than half a cent to about a cent. The costs for the least expensive system are an order of magnitude below feed costs. The installation costs are in the order of $15.00 to $40.00/animal or less than the capital cost as the least expensive confinement scheme. Economic feasibility is a combination of many things. One of the most important is the relevance of a particular item when all the costs are considered. The costs of waste treatment at feedlots would appear to represent roughly the same fraction of the total costs as seen in other industries. (See also W71-03542) (White-Iowa State)
W71-03546

THE ECONOMICS OF STORING, HANDLING AND SPREADING OF LIQUID HOG MANURE FOR CONFINED FEEDER HOG ENTERPRISES,
M. F. McKenna, and J. H. Clark.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 98-110. 12 tab.

Descriptors: *Farm wastes, *Hogs, *Storage capacity, Chemical analysis, Fertilizers, Storage tanks, Value, Soil contamination, Nitrogen, Phosphorus, Potassium, Nutrient requirements, Linear programming.
Identifiers: *Spreading, Seasonal application, Disposal costs.

The main hypothesis made at the outset of the study, that the economically optimal storage capacity would be affected by the density of hogs per acre and the crops under cultivation on the farm was supported. Of these two factors it was found that the ratio of hogs per acre was the more significant. For a spreading operation with the relatively high fixed costs associated with spreading, farms with smaller herd sizes were seen to encounter significantly higher spreading costs per hog than farms with larger herds. In some cases the extent of these costs will be sufficient to cancel out the positive value of the manure as a replacement for commercial fertilizer. It would therefore appear that significant savings might be realized if hog operators were to enter rental or custom arrangements for manure spreading. The overall conclusion reached in the study was that for Ontario conditions a land utilization program for the liquid manure supply does represent an economic means of handling the animal waste management problem. (See also W71-03542) (White-Iowa State)
W71-03547

LAND DISPOSAL OF DAIRY FARM WASTE,
Florida Univ., Gainesville. Dept of Agricultural Engineering.
A. R. Overman, C. C. Hortenstine, and J. M. Wing.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 123-126. 3 fig, 2 ref.

Descriptors: *Farm wastes, *Cattle, Dairy industry, Effluent, Nitrogen, Phosphates, Soil contamination, Groundwater, Water pollution, Florida, Sprinkler irrigation, Rates of application, Nitrate, Oats, Waste disposal.
Identifiers: *Dairy cattle, Land disposal.

Wastes from 160 cows in a new milking barn at the University of Florida are collected in a 20,000-gallon holding tank and removed daily. An open impeller pump is used to deliver effluent to sprinkler guns which apply 1/4, 1/2, and 1 inch per week. The plots were seeded to oats, with no mineral fertilizer added. Measurements were taken to determine effectiveness of the oats in utilizing nutrients. Groundwater samples were extracted weekly at depths of 30,45, and 60 cm. for chemical analysis. Results are reported for nitrate and orthophosphate content. It is concluded that the soil plant system can be effective in renovation of waste water farm animal operations. Removal of nitrogen and phosphorus is greatly enhanced by plant growth. Nutrient removal was found adequate up to an application rate of 1 inch per week effluent with solids content of about 0.115 percent. It appears that a more intense application rate could be used. (See also W71-03542) (White-Iowa State)
W71-03548

NITROGEN TRANSFORMATIONS AND PLANT GROWTH AS AFFECTED BY APPLYING LARGE AMOUNTS OF CATTLE FEEDLOT WASTES TO SOIL,
Southwestern Great Plains Research Center, Bushland, Tex.
A. C. Mathers, and B. A. Stewart.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 207-214. 8 fig, 2 tab, 3 ref.

Descriptors: *Farm wastes, *Cattle, *Nitrification, Denitrification, Nitrate, Nitrogen, Ammonia, Carbon dioxide, Greenhouses, Laboratories, Carbon,

Rates of application, Incubation, Phosphorus, Potassium.
Identifiers: *Feedlots, *Nitrogen transformations, Pullman silty clay loam, Yield.

The objectives of these studies were: (1) to determine the decomposition rates and nitrogen transformations of animal wastes when applied to soil at various rates; and (2) to study the effects on plant growth of applying large amounts of animal wastes to soil. Studies were carried out with 0, 1, 2.5, 5, 10, and 20% rates of cattle feedlot waste added to Pullman silty clay loam in both laboratory and greenhouse tests. Three conclusions were reached: (1) When feedlot waste was mixed with soil, evolution of C and transformation of N were rapid. In 90 days, about 50% of the C was evolved as CO2 and an equivalent amount of N was recovered as NH3 evolved, or as NH4.. and NO3- in the soil. (2) Nitrification was influenced by application rate of manure and moisture content of the soil during incubation. (3) In a greenhouse study, one unit of N from ammonium nitrate was equivalent to 2.4 units of N supplied in feedlot waste. (See also W71-03542) (White-Iowa State)
W71-03550

RATES OF WATER INFILTRATION RESULTING FROM APPLICATIONS OF DAIRY MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
For primary bibliographic entry see Field 04C.
W71-03554

POULTRY POLLUTION: PROBLEMS AND SOLUTIONS.
Michigan Agricultural Experiment Station, East Lansing.

Research Report 117, Farm Science, July 1970. 55 pages.

Descriptors: *Farm wastes, *Poultry, *Dehydration, Eggs, Nitrogen, Diets, Feeds, Odor, Water pollution, Air pollution, Soil contamination, Disease, Insects, Standards, Land use, Septic tanks, Sludge disposal, Digestion, Ventilation, Rates of application, Corn, Nitrate, Chemical properties, Drying, Moisture content, Nutrients, Taste.
Identifiers: Environmental quality, Indoor lagoons, Laying hens, Feed conversion, Egg production, Dehydrated poultry waste, Feed efficiency.

The report contains eleven articles with an introduction and a table compilation of properties of poultry waste that were analyzed. Reports on indoor septic handling of poultry manure and effect of application rate of chicken manure on corn yields are presented. A large part of the report deals with drying and feeding poultry manure to laying hens. Results of feeding dehydrated poultry waste to laying hens and its effect on egg production, feed conversion, body weight, egg weight, shell thickness, Haugh score, egg taste, and quality changes during storage are presented. Acceptability and digestibility of poultry and dairy wastes by sheep is also reported. Bacteriological procedures and current research being carried out at Michigan State University conclude the report. (See also W71-03556 thru W71-03564) (White-Iowa State)
W71-03555

POULTRY MANURE HANDLING BY INDOOR SEPTIC TANKS (SO-CALLED 'INDOOR LAGOONS'),
Michigan State Univ., East Lansing. Dept. of Poultry Science.
J. A. Davidson, and C. J. Mackson.
In: Research Report 117, Farm Science, MSU Agricultural Experiment Station, July 1970, p 8-9.

Descriptors: *Farm wastes, *Poultry, *Septic tanks, *Sludge, Sludge disposal, Digestion, Odor, Ventilation.
Identifiers: *Indoor lagoons, Laying hens, Compressed air agitation, Paddle wheel agitation, Floor space.

The report details the use of shallow water filled tanks for the disposal of poultry manure. The experiment was carried on for 5 years, during which time several variations were used. The original experiment consisted of a tank 10' x 24' x 2' deep in a pen 20' x 24'. The tank was filled with 18" of water and all droppings were caught in the tank. The second year, compressed air was used to agitate the material. Approximately 9 inches of sludge was cleaned out after 11 months of operation. Flies were no problem. Successive experiments used different amounts and methods of agitation. Each year the sludge accumulation was cleaned out with a septic tank service truck. Indoor septic tanks (indoor lagoons) covering 1/2 the floor space can handle the droppings from 300 laying hens for at least 11 months. This means one annual cleaning. This method could be used in cage operations. (See also W71-03555) (White-Iowa State)
W71-03557

THE EFFECT OF APPLICATION RATE OF CHICKEN MANURE ON THE YIELD OF CORN,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
L. S. Robertson, and John Wolford.
In: Research Report 117, Farm Science, MSU Agricultural Experiment Station, July 1970, p 10-15. 4 tab.

Descriptors: *Farm wastes, *Poultry, *Chemical properties, *Rates of application, Hydrogen ion concentration, Phosphorus, Potassium, Soil tests, Corn, Crop production, Michigan, Nitrate, Magnesium, Carbon.
Identifiers: *Plant food content, Huron County Michigan.

The report begins by giving an indication of the magnitude of the poultry manure problem in Michigan. Tables showing the chemical characteristics and plant food content of chicken manure are presented. The effect of high rates of manure application upon soil test results are shown. The application of 46.4 tons/acre of manure significantly increased the levels of phosphorus, potassium, magnesium, nitrate, and percent of carbon in the soil. At the same time, the pH level was reduced from 7.7 to 7.1. An experiment involving different rates of poultry manure application, one fertilizer application, and no treatment was used to determine the effect of chicken manure on corn grain yield. The use of commercial fertilizer did not increase corn yields. Previous field management made this result expected. The use of several rates of manure has not greatly affected the yields. The use of 46.4 tons/acre tended to decrease corn yields slightly. It is not known at the present time whether this apparent depression is real. The data suggest that a tremendous iuantity of chicken manure can be incorporated into the soil without any opportunity for damage to a corn crop. (See also W71-03555) (White-Iowa State)
W71-03558

DRYING ANIMAL WASTE,
Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.
T. C. Surbrook, J. S. Boyd, and H. C. Zindel.
In: Research Report 117, Farm Science, MSU Agricultural Experiment Station, East Lansing. July 1970, p 16-20. 5 tab, 1 fig.

Descriptors: *Farm wastes, *Poultry, *Cattle, *Hogs, *Drying, Moisture content, Nutrients, Bulk density, Costs, Screens, Electric power.
Identifiers: *Dryer operation, Hammermill, Drying chamber, Fuel consumption.

The report gives details and test results from a machine used for drying animal waste. Production figures for the drier while processing different kinds of animal excreta are given. Details of the drier operation are described. Initial moisture contents ranged from 72 to 82 percent. The machine incorporates inclined shaking surfaces and screens, a hammermill and temperatures from 200 to 1100F. The drier successfully processed dairy, beef, swine and poultry excreta. Costs to produce one ton of the dried product are given. A table gives projected numbers of animals which the machine might serve. Density and nutrient levels of the dried excreta are listed. Odors were less intense than that of fresh excreta. (See also W71-03555) (White-Iowa State)
W71-03559

THE UTILIZATION OF POULTRY WASTE AS A FEEDSTUFF FOR GROWING CHICKS,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
C. J. Flegal, and H. C. Zindel.
In: Research Report 117, Farm Science, MSU Agricultural Experiment Station, July 1970, p 21-28. 5 tab, 21 ref.

Descriptors: *Farm wastes, *Poultry, *Dehydration, Amino acids, Analysis, Chemical properties, Diets, Nutrients, Bacteria, Feeds, Efficiencies, Weight, Mortality.
Identifiers: *Feed composition, Dehydrated poultry waste, Significance, Feed efficiency.

Two experiments were conducted to determine the nutritional value of dehydrated poultry waste (DPW) for growing chicks from 1 to 28 days of age. The four-week mean body weight of Leghorn type chicks was not influenced when up to 20 percent of the diet consisted of the DPW. Diets which contained levels of 10 and 20 percent DPW, when fed to broiler-type chicks, resulted in a reduction in four-week mean body weight; 5 percent DPW had no influence on the four-week mean body weight. Food efficiency was inversely related to the level of DPW in the diet; i.e., the higher the level of DPW, the poorer the feed efficiency. However, in the trial in which broiler-type chicks were used, added fat placed in the diet which contained 20 percent DPW improved weight gain and feed efficiency. It is suggested that the DPW used in these trials was a low energy product. (See also W71-03559) (White-Iowa State)
W71-03560

THE RESULT OF FEEDING DRIED POULTRY WASTE TO LAYING HENS ON EGG PRODUCTION AND FEED CONVERSION,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
C. J. Flegal, and H. C. Zindel.
In: Research Report 117, Farm Science, MSU Agricultural Experiment Station, July 1970, p 26-30. 2 tab.

Descriptors: *Farm wastes, *Poultry, Eggs, Feed, Diets, Corn, Lipids, Calcium, Phosphorus.
Identifiers: *Egg production, *Feed conversion, Dried poultry waste, White Leghorn layers.

Four replicates of eight birds each were fed one of thirteen possible diets which were presented in tabular form. The 416 White Leghorn type layers were on test for 139 consecutive days. Each hen was confined in an individual cage having a floor area of 8 x 16 inches. The percent egg production on a hen housed basis and kilos of feed per dozen eggs produced are also presented in tabular form. These data are presently being statistically analyzed to determine the differences, if any, between the various treatments. It appears that hens receiving control rations containing 10, 20, and 30 percent dried poultry waste have respectively lower production and higher feed requirements per dozen eggs. (See also W71-03559) (White-Iowa State)
W71-03561

THE EFFECT OF FEEDING DEHYDRATED POULTRY WASTE ON PRODUCTION, FEED EFFICIENCY, BODY WEIGHT, EGG WEIGHT, SHELL THICKNESS AND HAUGH SCORE,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
C. J. Flegal, and H. C. Zindel.

Research Report 117, Farm Science, MSU
ricultural Experimental Station, July 1970, p 31-
3 tab.

scriptors: *Farm wastes, *Poultry, *Dehydra-
n, *Diets, Feeds, Eggs, Lipids, Efficiencies, Per-
mance, Weight, Protein, Nitrogen.
ntifiers: *Production, *Feed efficiency, Body
ight, Egg weight, Shell thickness, Haugh score,
nificant difference.

his egg production experiment, one replicate of
twenty-six-week-old Leghorn type pullets was
ced on each of five different rations. The rations
ied from 0% to 40% dehydrated poultry waste
PW) plus fat. The production trial was con-
cted for 366 days with the birds in individual
es on a 15-hour-per-day light schedule. Protein-
rogen supplied in each of the rations was calcu-
d to be equal. The highest percent egg produc-
n resulted in those birds which received 10%
W in the ration. Although production varied
n 61.62% to 53.16% production, there was no
nificant difference in hen housed production.
d efficiency again was inversely proportional to
amount of DPW in a ration, with the best effi-
ncy having 0% DPW in the ration. However, an
lition of animal fat to the ration resulted in a
ht improvement in feed efficiency. It is also in-
esting to note that those birds which received
re than 10% DPW in their diet did not increase
body weight comparable to the control ration.
e egg weight became smaller as the percent of
W was increased in the diet. These differences
e not significantly different. Although there
e slight differences in shell thickness, again
re were no significant differences due to the diet
ny of these rations. All of the experimental ra-
s had a significantly higher Haugh score than
control diet. The Haugh scores ranged from
7 to 76.8. (See also W71-03555) (White-Iowa
te)
1-03562

E EFFECT OF FEEDING DEHYDRATED ULTRY WASTE TO LAYING HENS ON THE STE OF THE RESULTING EGGS,
higan State Univ., East Lansing. Dept. of
ltry Science.
. Flegal, H. C. Goan, and H. C. Zindel.
Research Report 117, Farm Service, MSU
icultural Experiment Station, July 1970, p 34-
2 tab, 9 ref.

criptors: *Farm wastes, *Poultry, *Dehydra-
, Diets, Eggs, Evaluation, Taste, Control.
ntifiers: *Dehydrated poultry waste, Taste test,
nsumer Preference Panel.

ltry feces, from caged layers, were collected
dried. The resulting product was designated as
ydrated poultry waste (DPW). DPW was fed at
ary levels of 10, 20 and 30 percent to Single
nb White Leghorns in individual wire cages. A
e-type laying diet was used as a control. The
s were fed for four months before any eggs were
ected for taste panel evaluation. Eggs from
h treatment group were hard-cooked and
pared for a Consumer Preference Panel. The
s were evaluated on the basis of taste difference
then ranked for preferred taste. The dietary
ls of DPW fed had no significant (pA.05) effect
he taste of eggs. Panel members were unable to
ct any consistent taste difference for the DPW
control eggs. Two thirds of the time, panel
nbers liked the taste of the DPW eggs over the
e of the control eggs. In each ranking test, panel
nbers preferred the control eggs over the DPW
s. (See also W71-03555) (White-Iowa State)
1-03563

CEPTABILITY AND DIGESTIBILITY OF ULTRY AND DAIRY-WASTES BY SHEEP,
higan State Univ., East Lansing.
. Thomas.
Research Report 117, Farm Science, MSU
icultural Experiment Station, July 1970, p 42-
2 tab.

Descriptors: *Farm wastes, *Poultry, *Sheep, *Cattle, Protein, Nitrogen, Animal metabolism, Digestion, Cellulose, Lignins, Fiber, Diets.
Identifiers: Total digestible nutrients, Dry matter, Digestibility, Soybean meal, Nutritive value.

Dried poultry and dairy wastes as about one third the total mixed ration were readily accepted by sheep. The complete ration was about 60% digestible with a TDN value of about 56. The digestibility of the poultry feces was more than that of the dairy feces. Protein of these wastes was less digestible than that of soybean meal but had a biological value equal to that of soybean meal for growing sheep. (See also W71-03555) (White-Iowa State)
W71-03564

OXYGENATION CAPACITIES OF OXIDATION DITCH ROTORS FOR CONFINEMENT LIVESTOCK BUILDINGS,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Don D. Jones, Donald L. Day, and James C. Converse.
Purdue University, Engineering Extension Service, Bulletin No. 135, p 191-208. 12 fig, 5 ref. Proceedings 24th Industrial Waste Conference.

Descriptors: *Dissolved oxygen, *Oxygenation, Farm wastes, Equipment, Odor, Mass transfer, Theoretical analysis.
Identifiers: *Oxidation ditch, Alpha factor.

The oxidation ditch is one of the most successful methods for treating the staggering volume of animal manure that is being produced at the present time. The purpose of this paper is to present the oxygenation capacities of five aeration rotors tested at the University of Illinois. The rotors were tested in actual field installations with clean tap water in the ditch and the livestock removed. The parameter studies were blade immersion, blade design, rotor speed, and gross power requirements. There is little or no difference in oxygenation capacities between the angle iron bladed rotor and the rectangular plate rotor. The increase in oxygenation capacity is almost linear with depth of immersion or rotor speed. (Christenbury-Iowa State)
W71-03567

PRELIMINARY RESULTS OF A NOVEL BIOLOGICAL PROCESS FOR TREATING DAIRY WASTES,
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Ronald L. Antonie, and Fred M. Welch.
Purdue University, Engineering Extension Service, Bulletin No. 135, p 115-126, 1969. Proceedings 24th Industrial Waste Conference.

Descriptors: *Equipment, *Aerobic conditions, *Biological treatment, *Biomass, Farm wastes, Aeration, Microorganisms, Biodegradation, Chemical oxygen demand.
Identifiers: *Loading rate, Rotating Biological Contractor, Field test.

Field testing of a device called the 'Rotating Biological Contractor' or 'RBC' is the subject of this paper. The device consists of a series of discs which are mounted on a shaft and rotated while partially submerged in the waste to be treated. A microbial film develops on the surface of the discs. The rotation of the discs carry the microorganisms into the air for aeration so that they can carry on aerobic activity. The field tests have shown that the RBC can effectively treat waste from a dairy plant. Varying weather conditions have no apparent effect on RBC effectiveness. RBC characteristics of a large microbial population, flexible aeration capacity, little maintenance, low power requirements and predictable performance make the RBC an attractive process for biological treatment of dairy wastes. (Christenbury-Iowa State)
W71-03568

MISSION IMPOSSIBLE: DISPOSE ANIMAL WASTES,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
E. Paul Taiganides.
Purdue University, Engineering Extension Service, Bulletin No 135, p 542-549, 1969. 1 fig, 4 tab, 10 ref. (Proceedings 24th Industrial Waste Conference).

Descriptors: *Transportation, *Disposal, *Management, Farm wastes, Lagoons, Production, Anaerobic digestion, Aerobic treatment, Biochemical oxygen demand, Gases, Dehydration, Odor.
Identifiers: *Generation, *Processing, *Utilization, Waste management, Anaerobic lagoons, Gas production, Composting.

The development of a 'waste management technology' analogous to the new patterns of animal production and in harmony with our need to keep our natural resources from being polluted is not an impossible mission but rather a challenging mission whose resolution is requiring of engineers and scientists the same ingenuity that has been shown in developing modern methods of production of consumer goods. This paper discusses the changes and trends in the components of animal waste management. The discussion is divided into five areas: waste generation, waste transportation, waste processing, waste utilization and waste disposal. (Christenbury-Iowa State)
W71-03569

AEROBIC DIGESTION OF SWINE WASTE,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
D. D. Jones, J. C. Converse, and D. L. Day.
Proceedings of CIGR (Commission Internationale du Genie Rural), p 204-211, 1969. 7 fig, 2 ref.

Descriptors: *Oxygenation, *Aeration, *Foaming, Biochemical oxygen demand, Farm wastes, Swine, Lagoon, Dissolved-oxygen, Aerobic treatment, Odor, Gases, Liquid wastes, Waste water treatment.
Identifiers: *Oxidation ditch, *Total solids, Loading rate, Defoaming agent, In-the-building treatment.

An oxidation ditch for in-the-building treatment of swine waste was evaluated. Odorless aerobic treatment could be obtained under the self-cleaning slatted floors of a confinement building by connecting the ends of the liquid-manure gutters and adding a rotor aerator. The results indicate that loading rates of 6 cu. ft. or less per hog are not suitable for in-the-building, oxidation-ditch treatment. Loading rates of 8 cu. ft. per hog were most satisfactory. Oil was used as a defoaming agent when required. No foaming was encountered at loading rates higher than 8.5 cu. ft. per hog provided sufficient oxygen was supplied. The mixed-liquor, 5-day BOD of swine waste was reduced from 40,000 to 3,000 to 10,000 milligrams per liter. (Christenbury-Iowa State)
W71-03570

REUSE OF WASH WATER FOR CLEANING CAGED LAYER HOUSES,
North Dakota State Univ., Fargo. Dept. of Agricultural Engineering.
R. L. Witz, G. L. Pratt, and J. L. Sell.
Transactions of the ASAE, Vol 12, No 6, p 807-812, November 1969. 7 fig.

Descriptors: *Recirculated water, Farm wastes, Poultry, Storage tanks, Equipment, Odor.
Identifiers: Flushing gutters, Manure.

A liquid manure handling system was designed for a poultry house. Manure is collected in concrete gutters beneath the cages. A flushing process is used to clean the gutters. A wooden scrape is forced down the length of the gutter by pressure exerted by water that had been added behind the

scrape. The water was collected in an outside pit for reuse. This system has been effective for reducing the total quantity of water required for cleaning the poultry house. (Christenbury-Iowa State)
W71-03573

AEROBIC DIGESTION OF CATTLE WASTE,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
D. D. Jones, B. A. Jones, Jr., and D. L. Day.
Transactions of the American Society of Agricultural Engineers, Vol 11, 1968, p 757-761. 18 fig, 2 tab, 4 ref.

Descriptors: *Farm wastes, *Cattle, *Biochemical oxygen demand, Chemical oxygen demand, Aerobic treatment, Sludge, Aeration, Digestion, Regression analysis, Waste treatment.
Identifiers: *Loading rates, *Aerobic digestion, Dairy cattle, Beef cattle, Volatile solids, Fixed solids, Digesters.

The effectiveness was studied of the aerobic digestion process in the treatment of dairy and beef-cattle wastes. Waste from livestock being fed a high-concentrate ration was added in varying loading rates to laboratory aerobic digesters. This experiment indicates that, in the future, less emphasis should be placed on COD, VS, and FS and more on the measurement of BOD, which is a better indication of microorganism activity. BOD reductions of 70,60, and 76 percent and total VS reductions of 20,15, and 0 percent, respectively were obtained for loading rates of 125, 150, and 200 ml. from dairy cattle. Similar results were obtained using beef cattle waste. Under conditions similar to those prevailing in this study, significant reductions in biodegradable organic concentrations can be obtained. (White-Iowa State)
W71-03576

HOG WASTE DISPOSAL BY LAGOONING,
Illinois Dept. of Public Health, Springfield, Ill. Div. of Sanitary Engineering.
Charles E. Clark.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 91, No SA6, p 27-41, December 1965. 5 tab, 1 fig, 9 ref.

Descriptors: *Farm wastes, *Farm lagoons, Odor, Scum, Gases, Bubbles, Biochemical oxygen demand, Chemical oxygen demand, Coliforms, Sampling, Depth, Volume, Septic tanks, Dissolved oxygen, Costs, Nutrients, Chlorophyta, E. coli, Antibiotics, Nitrogen, Potassium, Phosphorus, *Hogs.
Identifiers: *Lagoon supernatant, Shock loading, Surface area, Farrowing house, Feeding house, Total solids, Volatile solids, Enterococcus, Penicillin, Algal population.

The material presented consists of on-site observations and test results obtained from samples collected from an operational farm lagoon in Illinois. The program centered on this lagoon since others around it had failed. The system itself is described and possible solutions given as to why it does work. Chemical properties of the lagoon supernatant and the raw waste are compared. On the basis of observations made during this program, the most likely problem will be process failure caused by antibiotic effect, temperature change or shock loading. Studies are underway concerning the harvesting and feeding of algae from the lagoon. Operational problems as well as costs are evaluated for the total system. Finally, a practical system is suggested for the disposal of hog wastes. (White-Iowa State)
W71-03578

POULTRY MANURE DISPOSAL - IS THERE A PROBLEM,
C. T. Riley.
Agriculture, Vol 73, 1966, p 110-112.

Descriptors: *Poultry, Costs, Nutrients, Farm wastes, Fertilizers, Value, Waste disposal.
Identifiers: Muck, Handling, Removal.

The cost is examined associated with removal of poultry manure from the house to the disposal point. It is costing the poultry farmer a shilling per bird per year to remove the muck. The fertilizer value of poultry manure should not be overlooked. Farmers dispose enough manure that would be worth 160 units of nitrogen, 160 units of phosphorus and 70 units of potash if applied to a crop. (Christenbury-Iowa State)
W71-03579

EFFLUENT DISPOSAL - STILL A MAJOR PROBLEM,
Wright Raine Ltd.
W. T. A. Rundle.
Journal and Proceedings of the Institution of Agricultural Engineers, Vol 21, p 134-139, 1965. 5 fig, 5 tab.

Descriptors: *Farm wastes, *Slurries, Sludge, Sprinkler irrigation, Pumping, Storage tanks, Labor, Volume, Rates of application.
Identifiers: *Field spreading, Vacuum tanks, Mechanical agitation.

Equipment and methods of manure disposal used in handling manure slurries are described. The equipment is broadly divided into two categories including mobile trailer type equipment and pumping equipment. Several examples of each are given. Tables list the waste production and labor required for each system as a function of volume handled. A digester is also described, which reduces the volume of material put in by 20%, and produces a sludge with no smell. It is suggested that the cost of this operation would be prohibitive. A discussion follows centering on problems and solutions to problems which have arisen from the systems discussed. (White-Iowa State)
W71-03581

THE EFFECTS OF VOLUME AND SURFACE AREA ON THE RATE OF ACCUMULATION OF SOLIDS IN INDOOR MANURE DIGESTION TANKS,
Nebraska Univ., Lincoln.
Ali A. Al-Timimi, W. J. Owings, and John L. Adams.
Poultry Science, Vol 44, p 112-115, 1965. 3 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, *Digestion tanks, Volume, Least squares method, Overflow, Lagoons, Waste treatment.
Identifiers: *Surface area, Dry matter, Hen weight, Feed consumption, Egg weight.

Ten stainless steel tanks were utilized to form four volume and two surface area allowances. Leghorn type pullets were placed in eight inch cages over the tanks and their manure was allowed to accumulate in liquid for 20 weeks. At the end of each 2 week period, dry matter determinations were made and hen weight, feed weight and egg production were recorded. The dry matter percentages were put on a 3.5 cu. ft/bird basis and the changes in per cent dry matter from one period to another were calculated. Cubage and surface area per bird seemed to have no significant effects on the rate of digestion of the solids in the tanks. Periods and the interaction between treatments and periods were highly significant. Although the manure output is influenced by factors such as hen weight, feed consumption and egg weight, none of these factors showed any significant effect, because of the uniform distribution of the hens assigned to the treatments. Liquid overflow was inversely related to the surface area per bird. At least 3.5 cu. ft of water per bird is needed to provide for biennial cleaning. (White-Iowa State)
W71-03582

A NOTE ON THE UTILISATION BY CHICKENS OF ENERGY FROM FAECES,
Queensland Univ., Brisbane (Australia). Dept. of Animal Husbandry.
W. J. Pryor, and J. K. Connor.
Poultry Science, Vol 43, p 833-834, 1964. 2 tab, 2 ref.

Descriptors: *Farm wastes, *Poultry, Energy, Wheat, Sorghum, Nitrogen.
Identifiers: *Metabolizable energy, Bomb calorimeter, Ration.

Four groups of male chickens aged 22 days which had been on a trial to determine the metabolizable energy of grain sorghum, were allotted at random two to each treatment. Two groups were fed crushed grain sorghum. The remaining two groups were fed a ration consisting of 80% crushed grain sorghum mixed with 20% feces resulting from a previous wheat trial. All four rations contained a standard broiler mineral and vitamin supplement. The results showed that the feces had a metabolizable energy value of approximately 30% of the feed from which it originated. (White-Iowa State)
W71-03583

THE MANAGEMENT OF LIVESTOCK MANURE,
California Univ., Davis. Dept. of Agricultural Engineering.
S. A. Hart.
Transactions of the ASAE, Vol 3, p 78-80, 1960. 4 fig, 1 tab, 13 ref.

Descriptors: *Farm wastes, *Disposal, *Management, Storage, California, Dehydration, Livestock, Fertilizers, Value.
Identifiers: *Composting, *Sanitation, Processing, House fly, Musca domestica, Carbon to nitrogen ratio, Production.

Manure management will seldom be a profit-making part of the farming enterprise. In most cases the cost of proper handling will exceed the value of the manure as a fertilizer or soil amendment. Even so, manure handling is as necessary a chore as is feeding or animal care. Through proper manure management the net cost of handling the manure can be minimized and the sanitation requirements of the farming operation fulfilled. The procedures of systems engineering are applicable to the management of livestock manure, and can be stated as the specific operations of: (a) gathering and cleaning up the manure, (b) storing or processing it, and (c) utilizing or disposal of it. (Christenbury-Iowa State)
W71-03584

SWINE WASTE MANAGEMENT-ANAEROBIC LAGOONS,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Arthur J. Muehling.
Cooperative Extension Service, University of Illinois at Urbana-Champaign, August 1969. 2 p. AENG-877.

Descriptors: *Hogs, *Farm wastes, *Anaerobic conditions, *Lagoons, Size, Sites, Construction, Shape, Depth, Odors, Sludge, Water pollution, Temperature, Intakes, Outlets, Grading, Management, Mixing, Organic matter, Stabilization.
Identifiers: *Loading rates, *Location, Solids, Wind action, Gas bubbling, Volatile solids.

Anaerobic lagoons were first adapted for the storage and treatment of hog wastes because of their low initial cost, ease of operation, and lack of serious alternatives. They have not always been successful, for sometimes they release objectional odors, they can pollute surface and underground water, they sometimes do not decompose the manure adequately, and in time they are apt to fill up with sludge. This fact sheet gives advice as to loading rates, size and location of anaerobic lagoons. Attention is given to the construction shape, depth, inlets and outlets, fencing, and grading of banks. Management practices include an adequate supply of water, correct start-up, continuous loading rates, restriction of solids, and adequate mixing. (White-Iowa State)
W71-03585

INE WASTE MANAGEMENT - CASES OM STORED SWINE WASTES,
ois Univ., Urbana. Dept. of Agricultural En-ering.
nur J. Muehling.
perative Extension Service, University of Il-is at Urbana-Champaign, August 1969. 2 p. g-879.

criptors: *Farm wastes, *Hogs, *Gases, Odors, on dioxide, Ammonia, Hydrogen sulfide, hane, Lagoons.
tifiers: *Threshold limit values (TLV), Air ity, Irritation, Lethal situations, Storage pit, centrations, Asphyxiation, Symptoms.

fact sheet concerns itself about the quality of air inside confinement swine buildings with ed floors since the wastes may be held in the ding long enough to produce gases and odors. ious gases and odors formed from stored es can be irritating to both the hogs and opera-and have been the cause of numerous com-its and even lawsuits by neighbors. The most rtant gases generated from stored manure, those discussed by the fact sheet are carbon ide, ammonia, hydrogen sulfide, and methane. potentially lethal situations of ventilation kdown, agitation of storage pit, and entering a ge pit are discussed and warnings given. ite-Iowa State)
-03586

NE WASTE MANAGEMENT - OXIDATION CH FOR TREATING HOG WASTES,
is Univ., Urbana. Dept. of Agricultural En-ering.
ur J. Muehling.
perative Extension Service, University of Il-s at Urbana-Champaign, August 1969. 2 p. g-878.

riptors: *Costs, *Farm wastes, *Hogs, sign, *Rotors, Effluent, Volume, Storage, Ox-, Biochemical oxygen demand, Aerobic bac-, Organic matter, Calibrations, Foaming, oorganisms, Odors, Dissolved oxygen, Color, erobic bacteria, Sludge.
tifiers: *Oxidation ditch, Rotor capacity, Rotor ersion, Rate of flow, Configuration, Detention

e has been considerable interest in aerobically ing hog wastes in an oxidation ditch because of eed for a low-odor method of manure storage reatment. This fact sheet gives guidelines as to n shape, capacity and loading, rotor capacity immersion, liquid depth and rate of flow. ational procedures are given as well as a ssion of problems that may arise. Solutions to problem of foaming include vegetable or leum oil, commercial products or a water . Sludge buildup and final disposal are given attention. Rotor costs are about $250 per and operation costs are estimated to between nd 1 cent per day per hog. (White-Iowa State)
-03587

FINEMENT SWINE HOUSING - SLOTTED ORS,
is Univ., Urbana. Dept. of Agricultural En-ring.
ur J. Muehling.
perative Extension Service, University of Il-s at Urbana-Champaign, August 1969. 2 p. g-875.

riptors: *Construction materials, *Reinforced rete, *Metals, Farm wastes, Dimensions, Cor-n, Failure, Durability, Depth, Height, Length, forcement, Hog.
ifiers: *Slotted floors, *Wood, *Spacing, Ex-ed metal, Farrowing, Feed wastage.

fact sheet lists wood, concrete and metal as effective for slotted floors. Advantages and vantages of each type are given, as well as nsions that should be used. Expanded metal and steel straps are both discussed as to their effectiveness for slotted floors. The amount and kind of reinforcing to use in concrete slats is given. Recommended spacing and advice for farrowing on slotted floors is also given. Pens with totally slotted floors remain consistently cleaner than those partially slotted. In general, the larger the pig the wider the slat that can be used without sacrificing cleaning efficiency. (White-Iowa State)
W71-03589

CONFINEMENT SWINE HOUSING - SPACE REQUIREMENTS,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Arthur J. Muehling.
Cooperative Extension Service, University of Illinois at Urbana-Champaign, August 1969. 2 p. AEng-874.

Descriptors: *Size, *Seasonal, *Temperature, *Ventilation, Farm wastes, Hogs, Confinement pens, Management, Performance, Economics.
Identifiers: *Space requirements, Method of feeding, Number of pigs per pen, Heat stress.

As confinement housing has changed to include total enclosure of feeding and sleeping area under roof, the minimum space requirements recommended for pigs in confinement have been reduced. These recommendations indicate the minimum amount of floor space per pig necessary to prevent a significant reduction in pig performance and to maintain a reasonable degree of cleanliness in the pen. The fact sheet lists space requirements for different weight ranges of hogs. These recommendations are based on research that has considered the more important factors affecting space needs. The factors discussed in the fact sheet include size of animal, season (as related to temperature), ventilation, method of feeding, level of management, and number of pigs per pen. (White-Iowa State)
W71-03590

A GROWING MARKET FOR WATER AND WASTEWATER TREATMENT EQUIPMENT,
Business and Defense Services Administration, Washington, D.C. Water Resources and Engineering Services Div.
K. I. Kollar, and William G. Youngwirth.
Water and Sewage Works, Vol 117, No 9, September 1970, p 319-325. 7 tab, 2 charts.

Descriptors: *Cost comparisons, *Cost analysis, *Surveys, *Costs, Construction costs, Evaluation, Economics, Equipment, Prices, Water treatment, Waste water treatment.
Identifiers: *Cost data, *Cost surveys, Market research.

This paper presents data obtained from questionnaire response of water and waste water treatment equipment manufacturers. The questions related to the manufacturing plant capacity, and the values of shipments of various kinds of water and waste water treatment equipment. The results of surveys conducted in 1965 and 1968 are reported. Tabulated data include: a summary of total expenditures and values of shipments of major equipment items; the sizes of manufacturing establishments based on the value of shipments; the value of all shipments of specific equipment items broken down into water treatment and waste treatment categories; values of total shipments and production capacities for plants manufacturing water and waste water treatment equipment; a comparison of the gross national product, total municipal water and waste water expenditures, and federal grants. In additon, charts showing municipal expenditures for water supply and waste water disposal from 1960 to 1980 (est.) are given. The collected data indicate that water and waste water treatment equipment account for 4.2% of total municipal expenditures, and 15.9% of total municipal treatment facilities expenditures. Approximately 11.2% of industrial construction costs are for water and waste water treatment equipment. (Hewett-Rutgers)
W71-03597

INDIVIDUAL WASTE DISPOSAL SYSTEMS,
Connecticut Univ., Storrs.
W. C. Wheeler, J. J. Kolega, R. P. Prince, and G. W. Hawkins.
Research Project Technical Completion Report, June 30, 1970. 8 p, 3 ref. OWRR Project A-001-CONN-4.

Descriptors: *Septic tanks, Waste water treatment, *Waste water disposal, *Aeration, *Temperature, Effluents, Spectrophotometry, Biological treatment, Pumping, Chemical oxygen demand, Hydrogen ion concentration.
Identifiers: Aspirators, Air diffuser, Synthetic effluent, Differential pumping.

Solutions containing trypticase soy as the primary degradable contaminant were found to give reproduceable results when used as the influent for studies using model septic tanks. When spectrophotometer readings for light emissivity of refluxed samples were applied to curves established for the media being used, the readings obtained were dependable COD indications. The efficiency of biological treatment processes in model septic tanks of the same volume was best for the tanks having the greatest surface areas. A sudden expansion type of aspirator was developed for adding air to liquid. It was more efficient than several other devices tested. The aspirator was used with a two-compartment aeration tank and a differential pumping scheme to produce effluent of excellent quality.
W71-03774

THE ISOLATION OF PROTOZOA AND ALGAE FROM THEIR BACTERIAL CONTAMINANTS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 05F.
W71-03775

EVALUATION OF PYRRONES AS MEMBRANES,
Franklin Inst. Research Labs., Philadelphia, Pa.
H. Scott, and F. L. Serafin.
NASA CONTRACTOR REPORT NASA CR-1648, September 1970. 35 p, 8 tab, 15 fig, 10 ref. Contract NAS 1-8609.

Descriptors: *Membranes, Desalination, Urine, Water purification, *Reverse osmosis, *Osmosis, Waste water treatment.
Identifiers: Polymidazopyrrolones, *Pyrrones.

The facile absorption of water by polyimidazopyrrolones (Pyrrones) suggested a feasibility study to use films of the polymers as membranes for the purification of water by reverse osmosis. This report describes direct osmosis measurements of water, salt, and urea fluxes through Pyrrone membranes. The data indicate comparable flux values and superior water-to-salt permeabilities of the Pyrrones relative to symmetric cellulose acetate membranes. Coupled with better mechanical strength and chemical resistance, these results suggest that the successful fabrication of asymmetric Pyrrone membranes could lead to substantial improvements over asymmetric cellulose acetate, from which the best reverse osmosis membranes are currently prepared.
W71-03780

DESIGN OF PLUG-FLOW POST-AERATION BASINS,
Rex Chainbelt, Inc., Milwaukee, Wis. Process Equipment Div.
Richard A. Kormanik.
Journal Water Pollution Control Federation, Vol 42, No 11, November 1970, p 1922-1931. 5 fig, 2 ref.

Descriptors: *Aeration, Design, *Oxygenation, Sewage treatment, Waste water treatment, Dis-

solved oxygen, Effluents, Sewage effluents, Storage.
Identifiers: Post-Aeration Basins, Dissolved Gases, *Air-Diffusers, Detention time.

Regulatory agencies have begun to set requirements stipulating minimum allowable dissolved oxygen levels. Since most treatment process produce effluent meeting the required dissolved oxygen levels, post-aeration is required. This paper presents the development of design procedure for describing mathematically a plug flow post-aeration system utilizing diffused aeration. The developed design equations, as is the case for the completely mixed system, indicate that when the waste effluent flow is considered to have an oxygen utilization rate equal to zero, the post-aeration basin detention time does not become a design parameter of the system, and with an oxygen utilization rate taken under consideration, the number of air diffuser units required becomes proportional to the detention time. (Selby-Texas)
W71-03808

THE KINETICS OF ANAEROBIC LONG CHAIN FATTY ACID DEGRADATION,
Missouri Univ., Columbia. Dept. of Civil Engineering.
John T. Novak, and Dale A. Carlson.
Journal of the Water Pollution Control Federation, Vol 42, No 11, Nov 1970, p 1932-1943. 12 fig, 1 tab, 26 ref.

Descriptors: *Anaerobic digestion, Acids, Degradation, Waste water treatment, Metabolism, Oxidation, Kinetics, Sludge, Effluents, *Sludge digestion, Digestion, Storage, Liquid wastes.
Identifiers: *Fatty acids, Detention time.

Greases normally account for about 30% of the volatile matter in raw waste water sludge. The purpose of this study was to determine the rate at which fine selected long chain fatty acids could be degraded in an anaerobic system under optimum conditions. These fine fatty acids, which comprise about 90% of the fatty acids commonly found in waste water sludge, were each fed continuously to completely mixed laboratory anaerobic digestion units along with the necessary inorganic nutrients. Data were analyzed using a kinetic model based on the Monod equation which relates the biological solids retention time (SRT) to the effluent substrate concentrations. The degradation rates of the fine fatty acids fell into two groups: (1) the unsaturated acids were degraded most rapidly, undergoing greater than 90% removal at a detention time of 10 days and (2) rates of degradation of the saturated 14-, 16- and 18-carbon fatty acids were much slower and a decreasing rate was observed to occur with increasing chain length. (Selby-Texas)
W71-03809

INDUSTRIAL WASTE TREATMENT-FACT AND FICTION,
Atlantic Richfield Co., Philadelphia, Pa. Air and Water Conservation.
William B. Halladay.
Journal Water Pollution Control Federation, Vol 42, No 11, November 1970, p 2004-2008.

Descriptors: *Waste water treatment, *Industrial wastes, Legislation, Water Quality Act, Water quality.

Because there are many misconceptions about the efforts of industry to control water pollution, this paper attempts to distinguish some of the things that may be considered real or fictitious in the progress and development of industrial waste treatment today. Industry participated in hearings held to establish water quality standards under the Water Quality Act of 1965, and industry became aware of the necessity of pollution control programs. These programs are advancing but are hampered by lack of financing and the need for new technological breakthroughs. Some of the fictions the author refutes are that industry creates most pollution, that the nation is running out of water, that industry has all necessary techniques to clean up water, and that different types of pollution can be attacked piecemeal. Strong and weak points of the legislation is discussed. (Selby-Texas)
W71-03810

DEVELOPING A REGIONAL WASTE WATER SYSTEM,
Brazos River Authority, Waco, Tex.
Ross L. Jacobs, and Carson H. Hoge.
Journal Water Pollution Control Federation, Vol 42, No 11, November 1970, p 1951-1961. 1 tab.

Descriptors: Waste water disposal, Legislation, Texas, Industrial wastes, *Sewage districts, *Regions, Municipal wastes.
Identifiers: Revenue, Urban areas, Systems management.

Problems connected with providing for the proper collection and treatment of liquid wastes in metropolitan areas may often best be dealt with by providing a regional sewage system to serve several or all of its separate municipalities. This paper presents a history of regional systems in Texas. Problems that prompted the development of systems and the steps taken provide an overview of typical factors involved in such an effort. Engineering, legal, financial problems, industrial wastes, waste water concentration and components, bonding, and communications are the considerations discussed as they relate to Texas metropolitan areas. The report concludes that the Texas Water Quality Board and the FWQA have long recognized the advantages of a regional sewage system in urban metropolitan areas as a means of reducing pollution of the rivers and streams of the state, and that they have given a great deal of support to such systems that have been developed. (Selby-Texas)
W71-03811

FILTRABILITY INDEX AND MICROSCREENER DESIGN,
Research Triangle Inst., Durham, N.C.
Forest O. Mixon.
Journal Water Pollution Control Federation, Vol 42, No 11, Nov. 1970, p 1944-1950. 3 fig, 7 ref.

Descriptors: Design, Waste water treatment, Filtration, Screens.
Identifiers: *Filtrability index, *Microscreeners, Boucher theory, Microstraining.

The concept of filtrability index seems to be erroneously applied in the literature to the design of continuous rotary drum microscreeners. A revised version of microscreener theory is proposed in which the concept of the filtrability index is introduced slightly differently than in the past. New equations are presented for microscreener design, that predict operating capacities about 30% in excess of those predicted by the Boucher Theory. (Selby-Texas)
W71-03812

RAW SLUDGE PUMPING PROBLEMS AND INTERDISCIPLINARY SOLUTIONS,
Boston Metropolitan District Commission, Mass. Deer Island Sewage Treatment Plant.
Andrew P. Fisichelli.
Journal Water Pollution Control Federation, Vol 42, No 11, November 1970, p 1916-1921.

Descriptors: Sludge treatment, Maintenance, Sludge, Waste water treatment, Pumping, Massachusetts, Screens.
Identifiers: *Raw sludge, *Sludge pumping, Check valves, Grease buildup, Boston (Mass).

The operating problems of line plugging and check valve obstruction in raw sludge handling and transporting are reported. The research of this study pertains to the Deer Island Plant, Metropolitan District Commission, Boston, Massachusetts. The problems were minimized by improving the effectiveness of the screening operation and eliminatin or minimizing grease and oil buildup. Screenin problems were reduced by eliminating the use grinders and not returning screenings to the flo and the use of differential head pressure (up stream-downstream of the screen) as the primar control for the cleaning mechanism. A creosote base fuel oil solvent used once per week controlle grease accumulation. These problems are commo to all sizes of waste treatment facilities in varyin degrees. (Selby-Texas)
W71-03813

WATER AND WASTE WATER SYSTEMS T COMBAT CHOLERA IN EAST PAKISTAN,
Rader and Associates, Miami, Fla.
DeSoto B. McCabe.
Journal Water Pollution Control Federation, V 42, No 11, November 1970, p 1968-1981. 1 tab.

Descriptors: Sanitary engineering, Waste wat treatment, Water supply, Design, *Water trea ment, *Public health, *Environmental sanitation.
Identifiers: *Asiatic cholera, Systems engineerin East Pakistan.

Because East Pakistan is the 'incubator' of th world's cholera, it was chosen as the location for a intensive cholera research laboratory. This pape reports on the factors that must be taken into co sideration in attempting to improve the sanita conditions of the Bengalese people of Ea Pakistan, whose customs are related to the high i cidence of Asiatic cholera. Population densit family living habits, transportation facilities, an education are factors. The U. S. Governme financed a study of the feasibility of constructin water and waste water systems in Dacca in 195 Project design philosophy and project scope a discussed. The project was revised, taking into co sideration information obtained in the initial stud Existing facilities, operating procedures and wat supplies were considered; the system design wa planned for stage development, the first stag covering 10 years. (Selby-Texas)
W71-03814

COSTS AND MANPOWER FOR MUNICIPA WASTE WATER TREATMENT PLANT OPERA TION AND MAINTENANCE, 1965-1968,
Federal Water Quality Administration, Washin ton, D.C.
Robert L. Michel.
Journal Water Pollution Control Federation, V 42, No 11, November 1970, p 1883-1910. 20 fi 31 tab, 9 ref.

Descriptors: *Waste water treatment, Economic *Municipal wastes, Variable costs, Unit cost Electric power, Operating costs, Maintenanc Sewage treatment, *Personnel, *Costs.
Identifiers: Municipal waste water treatment.

Between 1965 and 1968, data was taken fro 1,600 plants during a study of labor, electrical, an chemical costs of waste water treatment operatio and maintenance. Unit costs (dollars or man-hou expended per unit load) declined exponentiall with increased plant size, thereby showin economics of scale. Labor and supervision a counted for 50 to 60% of operation and mai tenance expenditures, with electric power rankin next in importance, particularly in activated sludg plants. Chlorination operating expenses were abo 3% of total operating costs. Oxidation lagoons we shown to be an inexpensive form of treatment t operate. Use or non-use of sludge processing equi ment is the most critical factor in operation an maintenance costs. Vacuum filters are especiall expensive to operate. (Selby-Texas)
W71-03815

A DISCUSSION OF 'CONCEPTIONS AN MISCONCEPTIONS IN BIOLOGICAL OXIDA TION,'
Clemson Univ., S.C.
John F. Andrews.

n: Advances in Water Quality Improvement, Jniversity of Texas Press, Austin, Texas and Lon-on, England, 1968, p 176-177. 1 tab, 3 ref.

escriptors: *Biological treatment, *Oxidation, rickling filters, Activated sludge, Methane, Bac-ria, Waste water treatment.
lentifiers: *Biological oxidation.

he author refers to the article 'Conceptions and isconceptions in Biological Oxidation' by A. W. usch. (See W70-04773). The author says Busch as calculated using a 1 micron film thickness and heres 3 inches in diameter that a trickling filter ould contain less than 1 mg of solids/l of filter olume. When this is compared to the 2000-4000 g/l of solids commonly found in the conventional tivated sludge aeration tank it would appear that e trickling filter process is more inefficient (per nit volume) than the activated sludge process by veral orders of magnitude. Even if the film ickness were 100 microns, the activated sludge ration tank would still contain a much larger uantity of solids per unit volume than the trickling ter. The actual picture is not as black as that inted by Prof. Busch. If one compares the 2 ocesses, as currently used, it will be found that ere is not a great deal of difference in the volu-etric loading rates of the 2 processes. This is tabu-ed. Advances in solid-liquid separation devices d gas transfer devices will undoubtedly increase e allowable volumetric loading rates for the ac-ated sludge process. Advances such as the con-olled filtration process of Ingram's should also in-ease the allowable volumetric loading rates for the ckling filter process. Busch has also hypothesized at methane production may be a result of the ef-ct of environment on the more common bacteria; d, therefore, the methane bacteria may not exist separate species. He offers no evidence. P. H. ith has recently conducted experiments, using re cultures, which appear to disprove Prof. sch's hypothesis. (See also W70-04761) (Selby-xas)
71-03816

SCUSSION OF 'FACTORS TO BE CON-DERED IN THE DESIGN OF ACTIVATED UDGE PLANTS,'
anchester Univ. (England).
B. White.
Advances in Water Quality Improvement, iversity of Texas Press, Austin, Texas and Lon-n, England, 1968, p 203.

scriptors: *Activated sludge, *Design, Aeration, occulation, Waste water treatment, Sewage treat-nt.
ntifiers: *Simplex, Circulator, Detention period, mersion.

ce World War II, plant scale work has been car-d out at the Manchester, England, treatment nt to guide the design of new works recently mpleted. The developments have been carried t in close collaboration with machinery manufac-ers, resulting in a significant improvement in the sign of 'Simplex' surface aeration units. The signed efficiency of the Mark III E type, installed the new plant, is 4 pounds oxygen for brake rse-power-hour, and it achieves intensive aera-n without danger to the sludge floc. The aerator nt consists of 8.8 pockets, each 35 feet square d 10 feet deep. Each pocket has a Mark III E ator rotating at 45 rpm and absorbing 20 bHP der maximum immersion conditions. The deten-n period is 2.82 hours. The sewage treated is y strong and contains a large fraction of indus-l wastes. Detention periods three or four times ger would previously have been required. The rsepower per million Imperpial gallons treated is for aeration alone. Recirculation of activated dge requires further 7 HP per million gallons. e also W70-04775 and W70-04761) (Selby-xas)
71-03817

A DISCUSSION OF 'ANAEROBIC TREATMENT OF SOLUBLE WASTES,'
Clemson Univ., S.C.
John F. Andrews.
In: Advances in Water Quality Improvement, University of Texas Press, Austin, Texas and London, England, 1968, p 353-354. 5 ref.

Descriptors: *Anaerobic conditions, *Trickling filters, Biological treatment, Oxidation, Solubility, Wastes, Waste water treatment.
Identifiers: *Anaerobic treatment, Filter media, Hydraulic upflow.

The author refers to 'Anaerobic Treatment of Soluble Wastes' by P. L. McCarty. (See W70-04783). McCarty has stated that his proposed process (Anaerobic trickling filter with hydraulic upflow) is limited to soluble wastes and has performed his experiments using the soluble substrates methanel, formic acid, acetic acid, and propionic acid. He has shown in these experiments that the process gives a high percentage of COD removal with a low solids concentration in the effluent. However, by using soluble substrates which are directly metabolized by the methane bacteria he has neglected solids produced in the conversion of such soluble wastes as sugars to volatile acids. Speece and McCarty have shown that this can be significant in that as much as 0.46 grams of solids can be produced per gram of glucose COD utilized. They also indicate that the major portion (0.406 gm) are produced in the conversion of glucose to volatile acids. The solids produced are destroyed at a relatively low rate and may result in the clogging of the filter media and/or pass over in the effluent from the reactor. The filter media used by McCarty may be unnecessary. A vertical multi-stage reactor, such as that proposed by Gates et. al., would make more efficient use of the reactor volume, reduce the danger of clogging and permit the digestion of both soluble and insoluble wastes. This upflow reactor consists of a mixed lower chamber in which anaerobic decomposition occurs, a solids separator just above the lower chamber which returns solids to the lower chamber, intermediate baffles to prevent oxygen from the aerobic compartment from reaching the anaerobic chamber and separator, and an upper chamber for odor control. (See also W70-04761) (Selby-Texas)
W71-03818

PROBLEMS OF POLLUTION CONTROL,
Oklahoma State Univ., Stillwater. Engineering and Industrial Extension.
James H. Suddreth.
Proceedings available from Oklahoma State University, Engineering and Industrial Extension, Stillwater, Okla, Price: $5.00. Proceedings, 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 1-6.

Descriptors: *Water pollution, *Water pollution control, *Pollution abatement, Waste water treatment, Operations and maintenance, Sewage treatment, Water quality control.

The primary purpose of ancient sewers was ground and surface drainage. The use of water for collection and transport of human wastes was not generally adopted until the nineteenth century. Eventually, sewage production and discharge to streams surpassed the ability of the stream to assimilate the waste and pollution resulted. Therefore, it became necessary for man to treat his waste water before discharging it to the receiving stream. The following steps are recommended for solving pollution control problems at the treatment plant level. Recognize the problem, gather the data, list possible solutions, test possible solutions, select final solution, implement solution, follow up action. The individual waste water treatment plant operator must make decisions daily. It is important that he have all the facts available, know the importance of time in the problem, understand the implication of action vs. inaction, and be able to implement his decision. Adequate knowledge of plant unit operations and preventive maintenance help the operator avoid embarassing problems. Three example problems and their solutions are discussed in an effort to illustrate problems that occur in waste water treatment plants. (See also W71-03820 thru W71-03829) (Makela-Texas)
W71-03819

OPERATION AND MAINTENANCE OF A PRIMARY CLARIFIER,
Shawnee Water and Sewer Dept., Okla.
Del Chancellor.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 7-13.

Descriptors: *Sewage treatment, *Operation and maintenance, *Settling basins, *Sedimentation, Settling velocity, Septic tank, Waste water treatment.
Identifiers: *Primary treatment, Imhoff tank, *Clarifiers.

This article gives a basic review of the purposes of a primary settling tank, the types of tanks commonly found, and the operation and maintenance of settling tanks. The purpose of a primary settling tank is to remove settleable solids by reducing the velocity of waste water flow. Four types of settling tanks in use are the septic tank, the Imhoff tank, the rectangular sedimentation basin, and the circular sedimentation basin. The Imhoff tank combines solids settling and digestion in one unit. Control of foaming in the Imhoff tank and routine operations are discussed. Expected removal rates are 40-60% for suspended solids and 25-35% for BOD. Inlet design, use of baffles, outlet weir design, surface settling rate, and detention time are discussed for rectangular and circular tanks. Circular tanks have greater structural strength and are more economic to build than rectangular tanks suspended solids removal rates of 90-95% and BOD reduction of 35-45% can be expected. Routine operations are discussed with emphasis on sludge removal and preventive maintenance. (Makela-Texas)
W71-03820

BUTTERFLY VALVES,
Dresser Research, Tulsa, Okla.
William C. Gilmore.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater, (1969), p 14-26.

Descriptors: *Butterfly valves, *Valves, Flow control, Operation and maintenance, Water distribution, Water treatment, Waste water treatment.
Identifiers: Butterfly valves.

Some advantages of the butterfly valve are simplicity of construction, low initial cost, bottle-tight shutoff, ease of operation, and a minimum of maintenance. Initial valve costs are low due to lack of need for expensive modifications to pipe layout. Butterfly valves weigh one third as much and occupy one half as much space as conventional gate valves. Installation is easier. The valve can be operated by one man. 100% bottle-tight shutoff at full rated pressure is obtainable. Corrosion is reduced by use of cast iron, 304 steel, rubber and Teflon for all wetted parts. Head loss is equivalent to a pipe elbow, but greater than losses in other type valves. (See also W71-03819) (Makela-Texas)
W71-03821

WATER FILTRATION,
Oklahoma State Univ., Stillwater.
A. Y. Hyndshaw.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 27-36.

Descriptors: *Filters, *Filtration, *Water treatment, Water purification, Activated carbon, Sands, Uniformity coefficient, Waste water treatment.

Identifiers: Filter media, Anthracite, Mixed media filtration.

A review of water treatment by filtration is presented. The early history of water filtration, and the discovery that pathogenic organisms were removed by filtration are discussed. Filters may be classified by force of movement, rate of filtration, filter material, or application. Rapid sand filters are the most popular and most common type filter in use. They are generally operated at 2-4 gallons per square foot per minute and are preceded by coagulation and sedimentation. General design criteria include 8-10 ft. overall basin depth, 12-15 inches underdrain, 9-18 inches support media, 24-30 inches filter media, 4-5 ft. water depth, and one foot of freeboard. Filter media effective size and uniformity coefficients are given for sand, anthracite, activated carbon, and mixed media. Rapid sand filters are usually gravity operated at 2-4 gpm/ft sq. Backwashing is necessary when head losses reach 8-9 ft. Bed expansion of 20-60%, (40% avg.) is desired. Backwash for 5-10 minutes is required every 12-40 hours for single media, and 25-85 hours for mixed media. Media effective size and depth are determined by head loss and floc penetration characteristics of the media. Mixed media filtration is the most important development since the introduction of rapid sand filtration. Mixed media filtration allows removal in depth, thereby acheiving greater filtration efficiency and filter runs 2 1/2 times longer than single media. For most efficient operation, mixed media must expand at the same rate during backwashing. Bacteria and grease coatings on activated carbon decreased efficiency and may require carbon regeneration. (See also W71-03819) (Makela-Texas)
W71-03822

NEW DEVELOPMENTS IN AUTOMATIC CATHODIC PROTECTION FOR WATER STORAGE TANKS,
Oklahoma State Univ., Stillwater.
Ed Morris.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 37-44.

Descriptors: *Cathodic protection, *Automatic control, Corrosion, *Corrosion control, Electrodes, Potentiometers, Waste water treatment, *Storage tanks, Storage.
Identifiers: Potentiostat polarization control.

The development of potentiostat polarization control is the latest development in automatic cathodic protection for water storage tanks. The rate of corrosion activity within a structure varies with many factors including water resistivity changes, water corrosivity changes, accumulated ampere hour effect, loss of coating effectiveness, anode consumption, and water level fluctuation. Automatic corrosion control devices require consideration of all these variables. Early corrosion control devices depended on a constant corrosion activity for maximum effectiveness and consisted of a rectifier and anode system. The automatic potential control developed in the early 1960's consisted of a reference electrode continuously monitoring the structure potential and regulation circuit which controlled D.C. output from the anode system. A limitation of this method of corrosion control was the fact that only one reference electrode was used and it measured the potential on only a small area of the structure. Also a copper/copper sulfate reference electrode could not be used because of inability to maintain a saturated copper sulfate solution when in water service. To overcome these limitations the potentiostatic polarization control was developed. It features the use of a copper/copper sulfate electrode, which maintains the desired potential of -0.85 volts. The new system offers three separate control circuits for the application, regulation, and measurement of cathodic protection. The most dramatic improvement is the bridge circuit potentiostat polarization control similar to a wheatstone bridge electrical circuit. This circuit allows the measurement of structure potentials free of IR drops in the water and coating. The use of several reference electrodes, each of which is capable of monitoring large areas, allows the monitoring of the complete structure. (See also W71-03819) (Makela-Texas)
W71-03823

SLUDGE HANDLING AND DISPOSAL,
Tennessee Dept. of Health.
H. B. Rosson.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 45-52. 2 ref.

Descriptors: *Sludge, *Sludge treatment, *Sludge disposal, Sludge digestion, Fertilizers, Waste water treatment, Waste disposal.
Identifiers: Sludge handling, Composting.

Sewage sludge is the accumulated settled solids removed from sewage by sedimentation. Descriptive of source, it may be termed primary, secondary, excess activated, or chemical. Descriptive of treatment received, it may be termed raw, digested, elutriated, dewatered, or dried. The solids content of sludges vary from 0.5% to 15% depending on the treatment received. Economic values in sludge include its potential use as animal feed, fertilizer, high calorific fuel (7,700 BTU/pound raw solids), and production of useful combustible gases when anaerobically digested 770BTU/cubic foot of gas). The primary purposes of sludge treatment are reduction of sludge volume and destruction of its putrescibility. Unit operations useful are thickening, chemical conditioning, elutriation, biological flotation, vacuum filtration, air drying, heat drying, digestion, incineration, or a combination of the above. Final disposal methods used include landfill, incineration and landfill, ocean disposal, lagooning, use as fertilizer and composting. A Johnson City, Tennessee plant, now composts the city's refuse and sludge together producing 25 tons/day of mixed compost. Sludge is used at the rate of 12% by weight for best results. (See also W71-03819) (Makela-Texas)
W71-03824

CHLORINATION OF WASTE WATER,
Tennessee Dept. of Health.
H. B. Rosson.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 53-60. 6 ref.

Descriptors: *Chlorination, *Waste water treatment, *Sewage treatment, Disinfection, Odor, Corrosion control, Effluents, Public health, Environmental sanitation, Diseases.
Identifiers: *Chlorine demand.

The Water Quality Act of 1965 requires chlorination of all waste water effluents which exceed maximum allowable limits for coliform. The most important function of chlorination of waste water is disinfection and ultimate destruction of pathogenic bacteria, virus, and amoeba. Other benefits of chlorination are odor control, BOD reduction, corrosion control, grease removal and control, control of psychoda files and trickling filters, control of trickling filter ponding, control of activated sludge bulking, thickening of waste activated sludge, and prevention and removal of bacterial slime growths. Odor control is effected by reaction of chlorine with H_2S to precipitate sulfer. However, less chlorine is required to kill the H_2S producing organisms. Therefore, prevention of odors are more economical than remedial action. BOD reduction in the range of 15% to 35%, with an average of 20% to 25%, can be expected with 0.2-0.5 ppm orthotolidine residual after 10 minute contact. Corrosion control is also effected by elimination of H_2S before it reacts to form sulfuric acid. Grease removal is obtained by prechlorination at 2-5 ppm. Psychoda flies can be killed by weekly applications of 3-10 ppm chlorine. (See also W71-03819) (Makela-Texas)
W71-03825

LABORATORY TECHNIQUES FOR DISSOLVED AND SUSPENDED SOLIDS: TOTAL, VOLATILE, AND FIXED,
Oklahoma State Univ., Stillwater.
Patricia J. Turner.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 61-70. 4 ref, 3 tab.

Descriptors: *Analytical techniques, *Dissolved solids, Laboratory tests, Waste water treatment, Solid wastes.
Identifiers: *Suspended solids.

The purpose of laboratory work is to collect data which can be practically applied to a water pollution control program. Accuracy and neatness in technique are most important. Consistency in sample is also much desired. The author recommends a properly refrigerated 24 hour composite sample for use in dissolved and suspended solids determination. The author also gives a step by step outline of the procedure to follow in determining total, volatile, and fixed dissolved and suspended solids. A commentary on important points accompanies this procedure. Both dissolved and suspended solids tests are based on a loss in weight due to precise temperature drying. An accurate weight must be determined by a consistent method, and a constant weight must be reached at every drying point. With practice, this technique can be used by any waste water treatment plant operation to check the efficiency of operation of each treatment unit in the plant. (See also W71-03819) (Makela-Texas)
W71-03826

WATER WORKS RECORD KEEPING,
Oklahoma State Univ., Stillwater.
B. J. Bourlon.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 71-81.

Descriptors: *Costs, Operation and maintenance, Budgeting, Cost allocation, Cost analysis, Personnel management, Waste water treatment.

This article briefly states the reasons for keeping records in a municipal Water and Waste Water Treatment Department. Records serve as a data source for analysis, planning, and control. Records can be kept in three main areas; progress, planning, and budget support. Records should be simple, clear, concise, and should contain all necessary and pertinent data. Unused records are a waste of time and money. Records can be kept in many activities including the following which are discussed in some detail: activity expenditure control which covers cost controls in personnel services, maintenance and operation, contractual services, and capital outlays; time studies which yield comparison records of times for use in judging the efficiency of operation of employees and procedures; personnel records, both background and on-the-job; research and development; job analysis and work orders which enable the determination of efficiency of man-hours and materials; maintenance records, production records; laboratory analysis records of water quality tests, etc. One of the most important uses of records lies in the area of budget preparation. (See also W71-03819) (Makela-Texas)
W71-03827

OPERATION AND MAINTENANCE OF A PRIMARY CLARIFIER,
Oklahoma State Univ., Stillwater.
B. J. Bourlon.
Proceedings of the 42nd Annual Water and Pollution Control School, Oklahoma State University, November 18-22, 1968, Stillwater (1969), p 82-9

Descriptors: *Sewage treatment, Operation and maintenance, *Settling basins, Sedimentation, Settling velocity, Waste water treatment.
Identifiers: *Primary treatment, *Clarifiers.

e purpose of primary treatment is to remove set-able solids from sewage and to prepare the solids disposal. A plain settling basin involves only ids settling and collection. Solids treatment oc-rs elsewhere. A multipurpose basin involves both tling and sludge treatment. Multipurpose basins e usually designated as septic tanks, or in one odification, as an Imhoff tank. This article cusses briefly several features of importance to mary clarification. Subjects discussed include: tors affecting sedimentation, short circuiting, et and outlet structures, features of plain primary rifiers, efficiency of plain primary clarifiers, dge withdrawal, maintenance of primary rifiers, performance expected, and record keep-. For example, a plain settling tank, under nor-l operation on raw domestic sewage, should nove 90 to 95% of the settleable solids, 40 to % of suspended solids and 30 to 40% of the OD; and it should concentrate the sludge to a isture content of 93 to 96%. (See also W71-819) (Makela-Texas)
71-03828

ABILIZATION POND OPERATION AND AINTENANCE,
lahoma State Univ., Stillwater.
ne L. Mansur.
ceedings of the 42nd Annual Water and Pollu-n Control School, Oklahoma State University, vember 18-22, 1968, Stillwater (1969), p 93-2. 7 ref.

scriptors: *Oxidation lagoons, Operation and intenance, *Lagoons, *Sewage lagoons, Sewage atment, Waste water treatment.

ste stabilization ponds provide a high degree of atment with a minimum of maintenance and erational expense, yet, because these ponds can erate with surprisingly little attention, main-ance and operational requirements are often glected. The purpose of this paper is to present ne guides to operations and maintenance of ste stabilization ponds. The author first defines a ste stabilization pond and its potential classifica-n as aerobic, anaerobic, or facultative. The func-ns of aerobic, anaerobic, and facultative bacteria l algae are discussed with respect to waste sta-zation ponds. Assuming proper pond design, the erator's goal is to provide favorable conditions algae and bacterial growth. At start up, it is pful to add commercial fertilizer at a rate of 200 per acre. The design water depth should be intained to allow the most efficient relationship ween time-detention capabilities and algae-sun-t-oxygen capabilities. Special releases should be de during periods of heavy rainfall or high water w. Weeds and floating scum should be removed ekly. An operation schedule and seasonal check for assistance in operation and maintenance of lagoon is given, and the use of several ponds in allel, or in series, or in combination is discussed h the viewpoint of maximum efficiency at vari-times of operation. (See also W71-03819) akela-Texas)
1-03829

E. Ultimate Disposal of Wastes

CROBIOLOGY OF SEWAGE LAGOONS-LE OF PURPLE SULFUR BACTERIA IN ABILIZATION OF INDUSTRIAL WASTES,
rth Dakota Water Resources Research Inst., go.
primary bibliographic entry see Field 05D.
1-03301

BSURFACE DISPOSAL OF LIQUID WASTES ONTARIO,
D. McLean.
tario (Canada) Department of Energy and ources Paper 68-2, December 1968. 91 p, 23 2 tab, 95 ref, 2 append.

Descriptors: *Waste disposal, *Injection wells, Industrial wastes, Waste water disposal, Hydrogeology, Aquifers, Confined water, Aquicludes, Geology, Permeability, Water chemistry, Water quality.
Identifiers: *Canada, *Waste disposal wells, *Ontario (Canada).

Ontario, as a site for subsurface disposal of wastes, is discussed in relation to its pecific geological and hydrological features, with regard to their suitability for disposal, and the policies and requirements of its regulatory agencies. The proposed disposal formation must be a uniform sandstone, limestone or dolomite aquifer, large in area and cross-section, with high porosities and permeabilities. The formation must be well below fresh water horizons and be contained by overlying and underlying impermeable strata. A salt water filled formation, artesian in nature, and containing no waters of economic value should be employed. The fluids present must be compatible with the ones to be injected. The region surrounding a proposed disposal well must be studied to ascertain whether there are any unplugged wells which penetrate the formation, or whether there is evidence of fractures or faults. Equations were developed for ideal conditions which permit accurate predictions of well performance, dispersion of waste and pressure buildup. The well must be constructed in such a manner as to protect all other horizons and to confine the waste to the disposal formation. It is essential that any disposal operation be monitored. (K-napp-USGS)
W71-03438

ULTIMATE DISPOSAL OF PHOSPHATE FROM WASTE WATER BY RECOVERY AS FERTILIZER,
Grace (W. R.) and Co., Clarksville, Md.
For primary bibliographic entry see Field 05D.
W71-03459

ULTIMATE DISPOSAL OF ADVANCED-TREATMENT WASTE, PART 1. INJECTION, PART 2. PLACEMENT IN UNDERGROUND CAVITIES, PART 3. SPREADING,
Louis Koenig-Research, San Antonio, Tex.
L. Koenig.
Available from NTIS as PB-168 796, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-8, Advanced Waste Treatment Research Program, US Public Health Service, Robert A Taft Sanitary Engineering Center, May 1964. 146 p, 22 fig, 31 tab, 78 ref. FWPCA Project 17070---05/64.

Descriptors: *Waste water treatment, *Economics, *Injection, *Underground storage, Water reuse, Waste water disposal, Waste disposal.
Identifiers: Spreading, *Ultimate disposal.

Cost estimates are made for ultimate disposal by injection to underground formation, placement in underground cavities and spreading, of the contaminants resulting from complete renovation of a municipal waste water. For injection, the process parameters were concentration of contaminants and daily volume taken respectively as 300,000, 9,000 and 300 ppm total organic and inorganic contaminants, and 1,000, 100,000 and 10 million gpd. These costs varied from $0.13 to $27 per 1,000 gallons injected (7,000 ft., 260 psi wellhead pressure, 1.187 fluid density) as the capability decreased from 2 million to 1,000 gpd. Cost is relatively independent of concentration and is very much cheaper than wet oxidation. For injection into cavities mined by conventional methods, fixed costs alone vary from $243 to $72 per 1,000 gallons at capabilities of 1,000 and 10 million gpd, respectively. Spreading is by far the cheapest method. Costs varied from $0.30 to $0.001 per 1,000 gallons as the capability varied from 1,000 (0.4-foot-per-day infiltration rate) to 10 million gpd (4.0-feet-per-day infiltration rate). Land costs had very little effect on over-all cost. Costs are 1 percent or less of other methods investigated, but spreading is severely limited because of potential groundwater pollution. (Selby-Texas)
W71-03513

ULTIMATE DISPOSAL OF ADVANCED-TREATMENT WASTE, PART 1. WET OXIDATION, PART 2. INCINERATION,
Louis Koenig-Research, San Antonio, Tex.
L. Koenig.
Available from NTIS as PB-168 977, $3.00 in paper copy, $0.95 in microfiche. Environmental Health Series AWTR-3, Advanced Waste Treatment Research Program, Public Health Service, Robert A Taft Sanitary Engineering Center, October 1963. 78 p, 19 fig, 11 tab, 49 ref. FWPCA Project 17070---10/63.

Descriptors: *Waste water treatment, *Economics, *Incineration, Oxidation, Waste water disposal, Waste disposal.
Identifiers: *Wet oxidation, Advanced waste treatment.

Cost estimates are made for ultimate disposal, by wet oxidation (Zimmerman Process) and incineration, of the concentrated contaminants resulting from complete renovation of a municipal waste water. For wet oxidation, nine hypothetical cases covered the flow ranges from 1,000 to 10 million gpd and organic contaminant concentration ranges from 100 to 100,000 ppm. Plant costs vary from $4 to $80 per gallon of concentrate per day capacity (10,000,000 to 1,000 gallons per day). Operating costs vary from $1.40 to $35 per thousand gallons of feed. Pre-evaporation could reduce costs. Fixed costs constitute a large proportion of total costs. A theory of the reaction mechanism is proposed. For incineration, consideration was given to the Atomized Suspension Technique, a box furnace flash dryer-Nichols Herreshoff furnace combination, and three processes under development for calcination of nuclear wastes. Estimates of pre-evaporation to 30% solids and hauling of ash were included. A flash dryer-Nichols Herreshoff furnace combination was selected. Costs per 1,000 gallons of concentrate varied from $0.57 (10,000,000 gallons per day, 300 ppm) to $68 (1,000 gallons per day, 300,000 ppm). Corresponding unit investment costs were $1.53 and $108 per gallon per day capacity. (Selby-Texas)
W71-03514

POND LININGS FOR DESALTING PLANT EFFLUENTS.
Bureau of Reclamation, Denver, Colo. Div. of Research.
For primary bibliographic entry see Field 05G.
W71-03523

MISSION IMPOSSIBLE: DISPOSE ANIMAL WASTES,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W71-03569

POLLUTION, PROPERTY AND PRICES,
Toronto Univ., (Ontario).
For primary bibliographic entry see Field 06C.
W71-03630

DEEP WELL DISPOSAL STUDY FOR BALDWIN, ESCAMBIA AND MOBILE COUNTIES, ALABAMA.
Geological Survey of Alabama, University.

Available from NTIS as PB-194 336, $3.00 in paper copy, $0.95 in microfiche. Circ-58, June 1970. 79 p, 8 fig, 10 plates, 15 ref. HUD Project Ala P-63 (G).
Identifiers: *Waste disposal, *Injection wells, *Water pollution, *Industrial wastes, *Alabama, Water pollution, Deep wells, Sedimentary rocks, Groundwater, Porosity, Stratigraphy, Permeability, Construction, Liquids, Chemical reactions, *Baldwin County (Alabama), *Escambia County (Alabama), *Mobile County (Alabama), *Water pollution control.

Baldwin, Escambia, and Mobile Counties have a combined area of 3,817 square miles and a population of 396,900 (1960 census). The area encompasses the highly industrialized Mobile metropolitan area and the port of Mobile. The area of study is underlain by sedimentary rocks of the type used as reservoirs for waste disposal in other parts of the United States. Under certain geologic, hydrologic, and geochemical conditions it is believed that deep-well injection of liquid industrial waste can be carried out effectively in southwest Alabama. Each proposal, however, must be carefully evaluated, using the criteria outlined in this report to insure against pollution of fresh-water supplies, surface and ground, and protect against damage to the environment in the subsurface or at the surface.
W71-03766

INDIVIDUAL WASTE DISPOSAL SYSTEMS,
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 05D.
W71-03774

SLUDGE HANDLING AND DISPOSAL,
Tennessee Dept. of Health.
For primary bibliographic entry see Field 05D.
W71-03824

5F. Water Treatment and Quality Alteration

REPORT ON WATER AND WASTE WATER FOR BROWARD COUNTY, FLORIDA.
Affiliates of Florida, Inc., Miami. Broward County Area Planning Board, Fort Lauderdale, Fla.
For primary bibliographic entry see Field 05D.
W71-03532

THE ISOLATION OF PROTOZOA AND ALGAE FROM THEIR BACTERIAL CONTAMINANTS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
Robert A. Coler, and Haim B. Gunner.
Phyton, Vol 26, No 2, p 191-194, November 1969. 3 fig, 11 ref. OWRR Project A-020-MASS (3).

Descriptors: *Isolation, *Bacteria, *Protozoa, *Algae, Lethal limit, Electrophoresis, Microorganisms, Electric currents, *Waste treatment, Waste water treatment.

A technique is outlined for the isolation of ciliated protozoa and green and blue-green algae from bacteria. The procedure is designed to exploit both the electrophoretic mobility of selected ciliated protozoa and flagellated algae and the apparently greater vulnerability of bacteria over protozoa and algae to the lethal affects of an electric field.
W71-03775

WATER AND WASTE WATER SYSTEMS TO COMBAT CHOLERA IN EAST PAKISTAN,
Rader and Associates, Miami, Fla.
For primary bibliographic entry see Field 05D.
W71-03814

5G. Water Quality Control

MANIPULATION OF RESERVOIR WATERS FOR IMPROVED QUALITY AND FISH POPULATION RESPONSE,
Wisconsin Dept. of Natural Resources, Madison.
Thomas L. Wirth, Russell C. Dunst, Paul D. Uttormark, and William Hilsenhoff.
Available from NTIS as PB-196 662, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Department of Natural Resources, Madison, Research Report No 62, 1970. 23 p, 2 fig, 7 ref. OWRR Project B-013-WIS (4).

Descriptors: *Aeration, Dissolved oxygen, *Hypolimnion, *Nutrients, Plankton, *Epilimnion, *Eutrophication, Water temperature, Wisconsin, Water pollution control, Water quality.
Identifiers: *Reservoir management, Cox Hollow Lake (Wisc), Twin Valley Lake (Wisc).

Compressed air continuously mixed Cox Hollow Lake, an 8-year-old eutrophic reservoir, for 3 years. Winter D.O. levels were greatly improved. The elimination of severe thermal stratification in summer resulted in: (1) considerable warming of deep water, (2) disappearance of high chemical concentrations near the bottom and recurrence of D.O., (3) habitation of profundal muds by invertebrates. There were no lasting improvements in water clarity or in several fish population parameters by the end of the study, although there was an increase in fish harvest. Eutrophication prevention by continual bottom-water discharge was studied in newly formed Twin Valley Lake. The hypolimnion was anaerobic during the summer resulting in high chemical concentrations. Large amounts of N and P were released, exceeding the potential amount for an epilimnion discharge; however, eutrophication was soon exemplified in high plankton densities and overabundant rooted vegetation. By the second fall the fish population exhibited signs of developing into a lower quality fishery. In the downstream channel warmer water in winter and colder water in summer benefited the growth and survival of stocked brown trout. Although the stream environment was still unsettled after three years, it was improved greatly. (See also W71-03308)
W71-03307

SOME EFFECTS OF HYPOLIMNITIC DISCHARGES ON TEMPERATURES IN THE STREAM BELOW,
Wisconsin Univ., Madison. Water Resources Center.
Paul D. Uttormark.
Supported in part by Wisconsin Dept. of Natural Resources. Available from NTIS as PB-196 663, $3.00 in paper copy, $0.95 in microfiche. Technical Report, Water Resources Center, University of Wisconsin, Madison, 1970. 34 p, 7 fig, 2 tab, 5 ref. OWRR Project B-013-WIS (5).

Descriptors: *Temperature, *Streams, *Dams, *Impoundment, *Hypolimnion, Downstream, Lakes, Discharge (Water), Mathematical studies, Wisconsin.
Identifiers: Hypolimnitic-discharges, Temperature modification, Mill Creek (Wisc), Twin Valley Lake (Wisc).

Temperature modification in streams as a result of hypolimnitic-discharges from impoundments is investigated from both an analytical viewpoint and a case study. A one-dimensional mathematical-analysis of stream temperatures as affected by hypolimnitic discharges is outlined and the interrelationships of stream depth, flow velocity, discharge temperature, and normal stream temperatures are discussed. There are three types of temperature effects that may occur depending on the time of year and the characteristics of the impoundment. Compared to those temperatures which would have occurred in the absence of the impoundment, maximum diurnal temperatures are reduced at all points in the downstream channel only when the discharge temperature is lower than the normal minimum diurnal temperature. Hypolimnitic discharges are also likely to increase the diurnal temperature fluctuation at points in the stream below. A technique is presented by which the general temperature changes which are likely to occur as a result of hypolimnitic discharges may be estimated. Although the technique has not been tested sufficiently to judge its general merit, it provides a resonable description of the changes observed in Mill Creek. (See also W71-03307)
W71-03308

SOME CONSIDERATIONS FOR WAT QUALITY AND ENVIRONMENTAL PROTE TION IN WILD AND SCENIC RIV DEVELOPMENT: THE CHATTOOGA RIVE A CASE STUDY,
Forest Service (USDA). Southern Region.
Daniel D. Bacon.
In: Proceedings Water Resources Conference, M sissippi State University, State College, April 15, 1970, published by Mississippi State U Water Resources Research Institute, p 135-1 1970. 9 p, 2 fig, 2 map, 3 tab, 4 ref. OWRR Proj A-999-MISS (6).

Descriptors: *Water quality, *Water pollut sources, *Wild rivers, *Water pollution cont North Carolina, South Carolina, Georgia, Sew disposal, Sewage treatment, Recreation, Scene Turbidity, Sediment yield, Wild river act.
Identifiers: *Chattooga River (NC-SC-Ga).

The Chattooga Wild and Scenic river (NC, SC, a Ga) study included study of water quality. T Chattooga River begins on the crest of the B Ridge in North Carolina. It flows southward for miles in North Carolina, then continues for miles as a boundary between the states of So Carolina and Georgia. About 90% of the watersh area is in forest, mostly mixed pine-hardwood ty The other 10% is in general type farms includ some pasture, row crops, and orchards, the urb area of Clayton, Georgia, and roads. Raw wa quality is excellent for most parameters tested the entire river and all its tributaries except river below Stekoa Creek and Stekoa Cre proper. Poor quality on Stekoa Creek and bel Stekoa Creek in the main river was due primarily a municipality emptying raw sewage into the cre The municipality is presently constructing modern sewage treatment plant which should leviate this condition. The other parameter t shows poor water quality is the high turbidity short periods following runoff producing storm Better conservation practices on agricultural la forest land, and roads, would keep the soil in pla rather than in the stream. (See also W71-0338 (Knapp-USGS)
W71-03388

WATER MANAGEMENT RESEARCH GROU FIRST REPORT (1969).
Organization for Economic Co-Operation a Development, Paris (France).
For primary bibliographic entry see Field 06A.
W71-03445

DEVELOPMENT OF A PORTABLE PIL PLANT TO DEMONSTRATE REMOVAL CARBONACEOUS, NITROGENOUS, A PHOSPHORUS MATERIALS FROM ANAER BIC DIGESTER SUPERNATANT AND SIMIL PROCESS STREAMS,
FMC Corp., Santa Clara, Calif. Central Engine ing Labs.
For primary bibliographic entry see Field 05D.
W71-03453

NEW MINE SEALING TECHNIQUES F WATER POLLUTION ABATEMENT.
Halliburton Co., Duncan, Okla.

For sale by the Superintendent of Documents, U Government Printing Office, Washington, D. 20402. Price $1.50. I67, 13/4: 14010 DMO 03/ Available from NTIS as PB-196 736, $0.95 microfiche. Water Pollution Control Research ries 14010 DMO-03/70, March 1970. 163 p, tab, 66 fig, 3 ref. append. FWPCA Program 14010 DMO, Contract No. 14-12-453.

Descriptors: *Pollution abatement, Water pol tion control, *Mining engineering, *Acid mi water, West Virginia, *Grouting, Cements, A gregates, Cement grouting.
Identifiers: *Mine sealing.

e purpose was to develop and field test new con-
ts for watertight mine seal and bulkhead con-
uction applicable to abatement of acid mine
ter pollution. Laboratory research determined
per materials, equipment and techniques for
structing mine seals or bulkheads. Field testing
conducted on remedial grouting techniques for
structing mine seals or bulkheads. Two new
cesses were developed. One involved a
nique of placing a plug of graded limestone ag-
gate in a mine drift or portal to neutralize an
mine water discharge until a seal was effected.
the process, precipitation of iron hydroxide
dually closed the pores. A pneumatic conveying
nique permitted placement of up to 550
nds per minute of aggregate into a mine drift.
second process consisted of remotely con-
cting a mine seal including rear and front bulk-
ds of a self-supporting, quick-setting sodium sil-
e cement specifically developed for this appli-
on. A filler material of expansive cement was
between the bulkheads to complete the seal.
d testing in West Virginia substantiated the
ibility of both processes when two aggregate
two bulkhead type seals were placed in aban-
ed mines which had drainage flows up to 58 gal-
per minute. Cost of the seals are reported.
-03456

CLEAR POWER STAGES COMEBACK,

mical and Engineering News, Volume 48, No
48-51, November 9, 1970. 1 fig, 1 tab.

criptors: *Nuclear power plants, *Electric
er industry, Desalination plants, *Natural gas,
Tennessee Valley Authority Project.
tifiers: *Fossil fuel, Monticello nuclear plant.

article discusses the future of nuclear power
ts as compared with fossil-fuel power plants.
city of fossil fuels, their rising cost and
lems of air pollution from burning them have
ed a turn-around in the outlook for nuclear
er. The coal shortage may be worse than at first
ected, due to the fact that only a fraction of the
rves are economically accessible. To a lesser
ee the status of the fuel oil supply is similar to
of coal. The same is true of natural gas. In
contrast is nuclear fuel, current exploration
ram has nearly doubled prime reserves of
8, the most abundant nuclear fuel raw materi-
Three fundamental reasons for the expected
inance of nuclear power are: low unit cost, its
ability, and the small volume of effluents from
ear plants compared with fossil fuel plants. The
cipal use of nuclear power in the future, other
electrical power generation, is sea water
lination. The multipurpose plant or nuclear
plex (nuplex) will permit the thermodynamic
ntial of high temperature steam to be used for
r generation and the lower-quality heat for
llation and heating. (Herrera-Vanderbilt)
-03463

**D LININGS FOR DESALTING PLANT EF-
ENTS.**

au of Reclamation, Denver, Colo. Div. of
arch.
. Morrison, R. A. Dodge, J. Merriman, and L.
lisperman.
by Supt. of Documents, U. S. Government
ing Office, Washington, D.C. 20402 Price
). Office of Saline Water Research and
lopment Progress Report No 602, September
. 114 p, 13 fig, 37 tab, 11 photos, 14 ref, 4 ap-
. OSW Contract 14-01-0001-1306, W.O. 3.

riptors: *Brine disposal, *Ponds, *Desalina-
Seepage, *Linings, *Effluents.
ifiers: *Soil Sealants, Polyvinyl chloride,
r Ponds, Permeability tests, Desalting Plant,
altic concrete, Earth linings, Flexible linings.

ld and laboratory evaluation of lining materi-
roposed for use in brine disposal ponds was
ucted. Flexible membrane linings were the most effective for seepage control, followed by hard-surface linings, compacted earth, and soil sealants. The investigation and other studies show that soil sealants only reduce seepage and do not affect a complete seal, and that the service life of soil sealants is questionable. Recommendations on a monitoring system for measuring seepage losses from brine disposal ponds are included. (Morrison-Office of Saline Water)
W71-03523

SOILS AS AN ANIMAL WASTE DISPOSAL MEDIUM,
Minnesota Univ., St. Paul. Dept. of Soil Science.
William P. Martin.
Journal of Soil and Water Conservation, Vol 25, p 43-45, March-April 1970. 18 ref.

Descriptors: *Farm wastes, *Sails, Nitrogen, Phosphorous, Potassium, Soil water, Water pollution, Soil contamination, Soil surveys, Nutrients, Fertilizers, Soil properties, Value, Soil chemical properties, Soil physical properties, Soil erosion, Sedimentation, Minnesota.
Identifiers: Waste disposal medium.

Pollution of the soil-water complex occurs mostly because we have no other medium for waste disposal. The author discusses the various reactions which can be expected in soil with respect to nitrogen, phosphorous and potassium. The importance of erosion and sedimentation control is also pointed out. It was stressed that considerable additional information is needed if we are to maximize the use of the soil as a waste disposal medium in such a way as to minimize pollution. We must manage our natural resources to accomodate our waste disposal needs with a minimum of pollution and still produce nutritious food in adequate amounts for our rapidly increasing population. (White-Iowa State)
W71-03536

RAISING LIVESTOCK IN THE URBAN FRINGE,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. Ronald Miner.
Agricultural Engineering, Vol 51, No 12, p 702-703, December 1970.

Descriptors: *Odor, *Pollution abatement, Farm wastes, Pollutants, Legal aspects, Livestock, Planning management.
Identifiers: Urban-fringe.

More people in this country demand more and better-quality livestock production. However, the population is extremely sensitive to water and air quality. The livestock producer should recognize that there will soon be no livestock production area where environmental pollution is acceptable. All livestock production enterprises must be planned as though they will operate in the urban fringe. Livestock production units can and do cause pollution of the air and waterways if improperly managed. The most frequent complaint leveled at urban-fringe livestock production is that of odors. Through proper design and management the livestock operations may be made acceptable to the public. (Christenbury-Iowa State)
W71-03539

RELATIONSHIP OF AGRICULTURE TO SOIL AND WATER POLLUTION.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05B.
W71-03542

LEGAL RESTRAINTS ON AGRICULTURAL POLLUTION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William R. Walker.
In: Relationship of Agriculture to Soil and Water Pollution; Proceedings, Cornell University Conference on Agricultural Waste Management, Rochester, January 19-21, 1970, Ithaca, 1970, p 233-241. 31 ref.

Descriptors: *Water pollution, *Farm wastes, Water Quality Act, Legislation, Discharge, Pesticides, Riparian rights, Odors, Zoning.
Identifiers: *Agricultural pollution, *Common law, State regulations, Federal regulations, Equity, Trespass, Liability, Nuisance, Negligence, Strict liability.

The basis is discussed for recovery under common law for agricultural pollution. These include actions for trespass, nuisance, negligence, and strict liability. However, agricultural pollution is not likely to be effectively controlled with private litigation. The federal government has the necessary legislation to play a leading role in agricultural water pollution abatement and it is designed to encourage the states to take a more aggressive role. Public awareness of the seriousness of the pollution problem in general is ever increasing. State laws banning the use of DDT, and HEW decisions to phase out the use of some of the persistent pesticides would indicate that public pressure for action in the field of agricultural pollution will be increasing. Thus there would seem to be little doubt that the law has a continuing and expanding role to play if agricultural pollution is to be controlled. (See also W71-03542) (White-Iowa State)
W71-03552

A NOTE ON THE UTILISATION BY CHICKENS OF ENERGY FROM FAECES,
Queensland Univ., Brisbane (Australia). Dept. of Animal Husbandry.
For primary bibliographic entry see Field 05D.
W71-03583

ANNUAL REPORT 1970 DELAWARE RIVER BASIN COMMISSION.
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 06B.
W71-03592

INDUCED OXIDATION OF STREAMS AND WATER QUALITY CONTROL INSTITUTIONS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr., Frank W. Dittman, and Shaw L. Yu.
Water Resources Bulletin, AWRA, Vol 6, No 6, p 968-979, December 1970. 1 fig, 14 ref.

Descriptors: *Aeration, *BOD, *Optimization, *Dissolved oxygen, *Water quality control, Oxygen sag, Water Pollution treatment.
Identifiers: *Instream aeration, *Induced oxidation, *Oxygen dispersers.

The proof is rapidly mounting that instream aeration is a technically and economically feasible supplement to secondary treatment of wastes, an alternative to tertiary waste treatment. Some phenomena remain unexplained; and competing technologies, especially those employing molecular oxygen, are being explored vigorously. However, there are convincing arguments in favor of aeration on theoretical grounds, proved technology is available; and the first installations have already been made. While remaining questions are being further investigated, it is time to consider in more detail the broader aspects, as to the institutional, legal, and political hurdles to be overcome before advantage can be taken of the new technology. This paper first summarizes the state-of-the-art as far as technology is concerned; and then outlines the institutional problem. (Whipple-Rutgers)
W71-03593

WATER QUALITY ENVIRONMENT AS RELATED TO INDUSTRY,
Great Western Sugar Co., Denver, Colo.

For primary bibliographic entry see Field 06B.
W71-03604

WATER POLLUTION CONTROL AND ABATEMENT.
Iowa State Univ., Ames; Iowa Univ., Iowa City.

Ames, Iowa State University Press, Wilbrick, Ted L. and Hines, N. William, editors, 1965. 194 p.

Descriptors: *Water pollution, *Water quality, *Economic evaluation, Engineering, Water law, Waste water, Municipal water, Industrial water, Agriculture, Recreation, Sewage, Government, Water use, Waste disposal, Economic analysis.
Identifiers: *Iowa, Pollution control agencies.

This book is the result of the Iowa Water Resources Pollution Control and abatement seminar held at Iowa State University on November 9-11, 1965. The first part presents the water pollution problem as seen through the specialized vision of four different disciplines: engineering, economics, law and political science. The second part contains papers dealing with the present water pollution, and waste water disposal situations in the state of Iowa. The last section deals with the interest groups most often involved in conflicts over pollution issues: municipalities, industry, agriculture interests and outdoor recreation. (See also W71-03611 and W71-03612) (Murphy-Rutgers)
W71-03610

SCOPE AND CHALLENGE OF THE WATER POLLUTION SITUATION,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
In: Water Pollution Control and Abatement, Ames, Iowa State University Press, 1965, p 3-12.

Descriptors: *Water pollution, *Government, *Economic analysis, Water law, Taxes, Effluents, Waste water, Regional analysis, Water quality, Costs, Recreation, Optimization, Water treatment, Engineering, Rivers.
Identifiers: *Efficient charges, Regional organizations, Externalities, Market forces.

A number of national laws exist which are concerned with federal participation in water pollution control activities. The author points out that these have been somewhat successful but that a serious problem still exists. The economic considerations involved are discussed and it is shown that the application of conventional control practices have not resulted in a balancing of costs and returns to achieve maximum benefits from an optimum system for the control of waste disposal. The paper discusses the main issues in water quality management; the determination of water quality, the divising of the best physical system for achieving that quality and the determination of the best organizational and institutional arrangements for administering and managing water quality. The author finds that an effluent charge, weighted by the relative damaging effects of various effluents could be used to finance measures on a regional scale. In the concluding section, the role of regional organizations is discussed. (See also W71-03610) (Murphy-Rutgers)
W71-03611

ECONOMICS OF WATER QUALITY,
Iowa State Univ., Ames.
John F. Timmons.
In: Water Pollution Control and Abatement, Ames, Iowa State University Press, edited by Wilbrick, Ted L, and Hines, N. William, 1965, p 33-50.

Descriptors: *Water quality, *Economic analysis, Maximization, Welfare economics, Costs, Water use, Water demand, Pollution, Population, Water supply, Water law, Technology, Government, Optimization, Budgets, Prices, Cost benefit analysis, Measurement.
Identifiers: *Pollution control, Economic development, Institutions, Quality differentiation.

Water quality problems are explained within an economic framework designed for maximizing the satisfaction of human wants from the use of water. This study considers both the direct as well as derived demands for water in addition to the goods and services water helps produce. Investigation is made into the nature of and the growing demand for water and the economic dimension of water quality problems in relation to physical and structural dimensions, supply and demand characteristics, use interrelationships, and costs and benefits associated with particular uses and use methods. (See also W71-03610) (Murphy-Rutgers)
W71-03612

ENVIRONMENTAL REPERCUSSIONS AND THE ECONOMIC STRUCTURE: AN INPUT-OUTPUT APPROACH,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
W71-03622

ENVIRONMENTAL DISRUPTION AND SOCIAL COSTS: A CHALLENGE TO ECONOMICS,
Basel Univ. (Switzerland).
For primary bibliographic entry see Field 06A.
W71-03623

THE DISTRIBUTION OF THE BURDEN OF SEWER USER CHARGES UNDER VARIOUS CHARGE FORMULAS,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 06C.
W71-03629

POLLUTION, PROPERTY AND PRICES,
Toronto Univ., (Ontario).
For primary bibliographic entry see Field 06C.
W71-03630

PROBLEMS IN ACHIEVING SOIL AND WATER CONSERVATION.
National Academy of Sciences, Washington, D.C.

In: Readings In Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 516-527.

Descriptors: *Conservation, *Water resources, *Soil conservation, Population, Economic evaluation, Multiple-purpose projects, Time, Technology, Benefits, Costs, Government, Uncertainty, Recreation, Dams.
Identifiers: *Mixed objectives, Productivity, Exports, Imports, Scale of development.

In this paper an attempt is made to identify major problems which are hampering water and soil conservation efforts. The paper begins by explicitly defining the nature and meaning of conservation. It also looks at the nation's need for natural resources in the future, based upon projections of population growth, changing technology, exports and imports, and various uncertainties regarding the future. The problems stemming from the mixed objectives of resource conservation programs and the different viewpoints of many of the participants are then discussed. There is an evaluation of the conflicts which tend to arise in conservation programs, including those between major land and water uses, those arising in the practices and uncertainties of physical and biological reactions, those involved in the scale of development, and those arising from different time preferences. The last section of the paper studies how benefits and costs of conservation developments should be shared: (1) between public and private interests, (2) between individuals, (3) between private individuals and groups, and (4) between units of government. (See also W71-03631) (Murphy-Rutgers)
W71-03634

COMPLEX SYSTEMS ANALYSIS OF WATE QUALITY DYNAMICS: THE FEEDBAC SYSTEMS STRUCTURE,
Georgia Inst. of Tech., Atlanta. Environment Resources Center.
For primary bibliographic entry see Field 06A.
W71-03731

AN ECONOMIC EVALUATION OF CONNE TICUT WATER LAW: WATER RIGHT PUBLIC WATER SUPPLY AND POLLUTIC CONTROL,
Connecticut Univ., Storrs. Inst. of Wat Resources.
For primary bibliographic entry see Field 06B.
W71-03732

MAINE LAW AFFECTING MARI RESOURCES, VOLUME III: REGULATION THE COAST: LAND AND WATER USES.
Maine Univ., Portland. School of Law.
For primary bibliographic entry see Field 06E.
W71-03785

LAW AND THE ENVIRONMENT.
For primary bibliographic entry see Field 06E.
W71-03792

OUTLINE OF FEDERAL ENVIRONMENT LAW FOR THE PRACTICING LAWYER,
For primary bibliographic entry see Field 06E.
W71-03794

THE RIGHT TO A DECENT ENVIRONMEN PROGRESS ALONG A CONSTITUTION AVENUE,
For primary bibliographic entry see Field 06E.
W71-03796

THE SANTA BARBARA OIL SPILL,
For primary bibliographic entry see Field 06E.
W71-03798

OUR WATERS AND WETLANDS: HOW T CORPS OF ENGINEERS CAN HELP PREVE THEIR DESTRUCTION AND POLLUTION.
House Comm on Gov't Operations. Committee Government Operations (U. S. House).
For primary bibliographic entry see Field 06E.
W71-03802

WATER FOR ILLINOIS - A PLAN FOR TION.
Illinois State Technical Advisory Committee Water Resources, Springfield.
For primary bibliographic entry see Field 04A.
W71-03806

RESTORING THE QUALITY OF OUR VIRONMENT.
President's Science Advisory Committee, Washington, D.C. Environmental Pollution Panel.
For primary bibliographic entry see Field 06E.
W71-03807

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

STREAMFLOW GENERATING TECHNIQU A COMPARISON OF THEIR ABILITIES SIMULATE CRITICAL PERIODS DROUGHT,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 02E.
W71-03314

OUNDWATER SYMPOSIUM.
primary bibliographic entry see Field 02F.
1-03401

ATER MANAGEMENT RESEARCH GROUP: RST REPORT (1969).
ganization for Economic Co-Operation and velopment, Paris (France).

ganization for Economic Co-Operation and velopment, Ex 40101, 1970. 25 p, 6 append.

scriptors: *Planning, *Project purposes, *Water uirements, *Watershed management, Lakes, ervoirs, Eutrophication, Water quality, Apisals, Water demand, Water resources, Water rs, Water supply, Foreign research, Priorities, ustries, Conferences.
ntifiers: *OECD, *Water Management earch Group, Committee for Research peration, Foreign delegates, Industrial water ds.

s mimeo of the Water Management Research up (OECD) indicates five priority areas: water lity management, predictability of industrial er needs, documentation of findings, national arch programs, and management of integrated r basins. The report summarizes the progress in n of these segments. The appendices incorate details of the problems and a list of nally nominated delegates. (Wilde-Wisconsin)
1-03445

ORITY PROBLEMS IN WATER MANAGENT RESEARCH IN SOUTHERN EUROPEAN UNTRIES.
anization for Economic Co-Operation and elopment, Paris (France).

anization for Economic Co-Operation and elopment, Ex 40100, 1970. 9 p.

criptors: *Conferences, *Priorities, *Planning, reign research, *Water requirements, Water ity, Soil erosion, Desalination, Brackish water, er costs, Flood protection, Saline water intru, Coastlines, Industries.
tifiers: *OECD, *Committee for Research peration, France, Italy, Portugal, Spain, Turr Yugoslavia, Mediterranean region.

report was issued following the 1967 Barna meeting of the representatives of France, , Portugal, Spain, Turkey, and Yugoslavia. It marizes discussions of management problems an emphasis on segments deserving priorities. following problems received particular atten- soil erosion, desalination of brackish water, omy of water in industry, protection from ls, inflow of salt water into aquifers and estuand coastal pollution. The participants sed the need for management of water urces in the Mediterranean region as an essenprerequisite of economic development. (Wildeonsin)
-03446

UCED OXIDATION OF STREAMS AND TER QUALITY CONTROL INSTITUTIONS,
ers - The State Univ., New Brunswick, N.J. r Resources Research Inst.
primary bibliographic entry see Field 05G.
-03593

CTIONAL EVALUATION OF A WATER OURCES SYSTEM;
R. Beard.
Hydrologic Engineering Center, Technical r No 4, Jan 30, 1967. 18 p, 2 fig, 6 tab.

riptors: *Reservoir operation, Water manage- (Applied), Watershed management, Com- models, Computer programs, Multiple purreservoirs, Reservoirs, Planning, Simulation sis.
ifiers: *Reservoir evaluation.

This paper describes an elaborate computer program which simulates the operation of a water resource system for conservation functions such as water supply, power generation and low flow regulation. Constraints imposed by flood control requirements are recognized, but flood control operation is not included in the program. The functional evaluation includes the determination of water and power deliveries and shortages. The program will handle multiple river basin systems with any number of reservoirs, diversions and power plants. Input data must include specifications of the system configuration, details of component capacities, inflows and evaporation. Great flexibility exists in the detail of the input data. Regular and irregular operation intervals may be simulated, and seasonal and annual variations in system requirements and controlling factors are included in the program. A computer with a large memory and high speed is required for the use of this program. (Hewett-Rutgers)
W71-03598

ECONOMIC FACTORS AFFECTING SYSTEM DESIGN,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W71-03606

THE STUDENT'S T TEST IN MULTIPLE REGRESSION UNDER SIMPLE COLLINEARITY,
Northeastern Univ., Boston, Mass; and Baruch Coll., New York.
Bruce Cohen, and Damodar Gujarati.
Journal of Financial and Quantitative Analysis Vol V, No 3, p 341-351, September, 1970.

Descriptors: *Statistics, *Mathematical studies, *Regression analysis, Model studies, Monte Carlo method, Correlation, Sampling, Baste-squares method.
Identifiers: *T test, *Multicollinearity.

The validity is discussed of the conventional t tests on regression coefficients when there is serious multicollinearity in the explanatory variable. The study attempts to show that the conventional t tests will, in practice, reflect the rise in the true standard errors of the regression coefficients due to increasing multicollinearity. The paper also points out the danger involved in mechanically dropping variables from multiple regression equations based on t tests. This danger is present because, although the t values of the regression coefficients may not be significantly different from zero, the true values of these coefficients are in fact not zero if the explanatory variables are highly intercorrelated. These results are illustrated with Monte Carlo experiments. This paper is relevant to empirical water research using correlation techniques which depend on the standard t test to establish statistical significance. (Murphy-Rutgers)
W71-03607

ENVIRONMENTAL REPERCUSSIONS AND THE ECONOMIC STRUCTURE: AN INPUT-OUTPUT APPROACH,
Harvard Univ., Cambridge, Mass.
Wassily Leontief.
The Review of Economics and Statistics, Vol 52, No 3, p 262-271, August 1970.

Descriptors: *Input-output analysis, *Pollutants, Economic growth, Value added, Regional analysis.
Identifiers: *Environmental disruption, Externalities, Structural matrix, Input coefficient, Inversion, Final demand, Final consumption.

The incorporation of externalities such as pollutants into conventional input-output analysis is considered. Pollution is a by-product of regular economic activities and can be related in a measurable way to some particular consumption or production process. The quantitative dependence of the external output or input on the level of conventional activities is described by a technical coefficient and incorporated in the structural matrix of the economy. Therefore, within the input-output system, any change in the output level of pollutants can be traced either to changes in final demand for goods and services, changes in technical structure or a combination of both. Through examples, the author shows the effects of a given technological change in output on pollutants and the effects of such a change on sectoral and total demand for the factor. With given value added coefficients, one can estimate the effect of such a change on prices of various goods and services. This method can be applied in a regional or sectional basis and is relevant for water resource planners. (Siegenthaler-Rutgers)
W71-03622

ENVIRONMENTAL DISRUPTION AND SOCIAL COSTS: A CHALLENGE TO ECONOMICS,
Basel Univ. (Switzerland).
William K. Kapp.
Kyklos, Vol 23, No 4, p 833-848, 1970.

Descriptors: *Welfare economics, *Economic efficiency, *Water pollution, Air pollution, Resource allocation.
Identifiers: *Environmental disruption, *Social costs, Externalities, Feedback effect, National accounting, Shadow price.

The ability is considered of conventional economic theory to deal with the problems of social cost and environmental disruption. Environmental disruption is defined to include man's natural and social environment. Through examples of air and water pollution, the article demonstrates that problems of environmental disruption have complex interdependencies and delayed feedback effects of a nonmarket nature. Economic theory concentrates on and treats production, allocation, distribution, and exchange as if they occurred in a closed sphere and hence the theory often omits their effect on man's social and natural environment. Moreover, environmental disruption challenges the validity of traditional measures of efficiency and optimalization. As an alternative, it is suggested that economic theory abandon its concentration on purely formal definitions of utility and efficiency and adopt an approach related to human needs and requirements in the form of interdisciplinary research. (Siegenthaler-Rutgers)
W71-03623

GEOMETRIC PROGRAMMING: NEW OPTIMIZATION TECHNIQUE FOR WATER RESOURCE ANALYSTS,
Texas A and M Univ., College Station; and Texas Univ., Austin.
Wilbur L. Meir, Robert W. Lawless, and Charles S. Beightler.
In: Proceedings of the Fourth American Water Resources Conference, Commodore Hotel, New York, November 18-22, 1968, St. Anne, Illinois, Record Press, 1968, p 524-533.

Descriptors: *Optimization, *Cost minimization, *Water resource development, Economic evaluation, Mathematical studies, Computers, Costs, Model studies, Planning, Systems analysis.
Identifiers: *Geometric programming, Computer algorithm, Nonlinear programming.

The optimization technique of geometric programming is described and its adoption by the water resource analyst is recommended. This method permits the direct solution of a large class of optimization problems which were previously solved by approximating techniques. Invariance properties, which often are discovered as by-products of the solution algorithm, provide insight into the system being analyzed. The authors feel that many water resource optimization problems can be efficiently solved using this technique. The advent of computer algorithms for geometric programming holds promise to make this technique even more useful in the future. (See also W71-03625) (Murphy-Rutgers)
W71-03627

READINGS IN RESOURCE MANAGEMENT AND CONSERVATION.
Toronto Univ., (Ontario); and Clark Univ., Worcester, Mass.
For primary bibliographic entry see Field 06B.
W71-03631

THE METHODOLOGY OF WATER-RESOURCE SYSTEM DESIGN,
Harvard Univ., Cambridge, Mass.
Maynard M. Hufschmidt.
In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 558-570.

Descriptors: *Water-resources, *Optimization, Systems analysis, Economic efficiency, Income, Benefits, Costs, Decision-making, Technology, Investment, Demand, Economic evaluation, Government, Discount rate, Risk, Water supply, Capital costs, Rivers, Computers, Floods, Sampling, Streamflow.
Identifiers: *Water-resources system design, Present value, Lehigh River.

The author presents a methodology of water-resource system design for the purpose of incorporating new techniques into the planning method. Water-resource design involves application of decision-making techniques to investment problems in a systematic context and thus a workable methodology for design must be capable of dealing effectively with these attributes. The author devises a methodology with four related steps: (1) specifying the objectives of design; (2) translating these objectives into design criteria; (3) using the criteria to formulate specific designs of development and management for water-resource systems that fulfill the optimization objectives to the highest degree; and (4) evaluating the consequences of the designs which have been developed. (See also W71-03631) (Murphy-Rutgers)
W71-03632

COST/EFFECTIVENESS ANALYSIS: ITS TASKS AND THEIR INTERRELATION,
General Electric Co., Santa Barbara, Calif. TEMPO.
David S. Fields.
Operations Research, Vol 14, No 3, p 515-527, May-June 1966.

Descriptors: *Systems analysis, Resource allocation, Uncertainty, Evaluation, Mathematical model, Economic efficiency, Peak load capacity, Flow, Constraint.
Identifiers: *Cost/effectiveness analysis, Iterative process, System characteristic, Performance model, Cost model, Feed back process.

The application of the general theory of cost effectiveness to specific systems is considered. Cost effectiveness analysis indicates how alternative design decisions are related to systems costs as a function of system effectiveness. It identifies the values of the variable characteristics to be considered in changing the system and enables the decision-maker to evaluate systems and choose the one with the preferred characteristic. After the problem is clearly stated, the tasks are to consider alternative systems, establish an evaluation basis, formulate mathematically the relationship between system costs and the characteristic models and to analyze system costs versus effectiveness. The analysis of system costs versus effectiveness indicates the tradeoff among alternative systems. A preferred value can be determined for each effectiveness level and it is the minimum cost point. Thus, the method permits the decision-maker to select the system best suited for his requirements given resource constraints. This article is relevant for water resource planners concerned with methods to evaluate investment alternatives. (Siegenthaler-Rutgers)
W71-03654

STATISTICAL DECISION THEORY TECHNIQUES FOR THE REVISION OF MEAN FLOOD FLOW REGRESSION ESTIMATES,
Carnegie-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 02E.
W71-03681

DEFINITION AND USES OF THE LINEAR REGRESSION MODEL,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02A.
W71-03682

SIMULATION AND EVALUATION OF COMPLEX WATER SYSTEMS OPERATIONS,
Australian National Univ., Canberra.
For primary bibliographic entry see Field 02E.
W71-03688

COMPLEX SYSTEMS ANALYSIS OF WATER QUALITY DYNAMICS: THE FEEDBACK SYSTEMS STRUCTURE,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
John E. Knight, and William W. Hines.
Available from NTIS as PB-196 901, $3.00 in paper copy, $0.95 in microfiche. Environmental Resources Center, Georgia Institute of Technology, ERC-0570, September 1970. 88 p, 25 fig, 18 ref. OWRR Project A-023-GA (1).

Descriptors: *Water quality management, *Water quality control, *Water quality dynamics, *Social impacts, *Political constraints, *Economic conditions, Institutional constraints, Decision making, Public attitudes, Simulation analysis, Systems analysis.
Identifiers: *DYNAMO simulation language.

The objective of the research was to identify and demonstrate how the management and control of water quality in a region is influenced by prevailing social, political and economic conditions and to illustrate how these prevailing conditions and attitudes interrelate in an information feedback and control system to produce traditional modes of system response. A generalized model was tested under a wide range of policies and parameters to illustrate system response and sensitivity to changes. Industrial dynamics was used to model the multiloop, non-linear feedback system, and the DYNAMO simulation language was used to program the model for digital computer simulation, testing, and experimentation. The modeling phase isolated system variables and identified their relative magnitudes, periods and phasing in historically polluted watersheds. Different policies and parameters were tested in a refined model to determine their effect on total system response. Water quality management and control was found to be deeply embedded in a complex, information feedback system involving social, political and economic pressures and forces. The complex system response was found to be insensitive to many parameter changes and unintuitive in behavior. Some critical points were found and programs directed at these points showed significant changes in system response. (Conway-Georgia Tech)
W71-03731

6B. Evaluation Process

FACTORS AFFECTING RELOCATION IN RESPONSE TO RESERVOIR DEVELOPMENT,
Kentucky Water Resources Inst., Lexington.
Rabel J. Burdge, and Richard L. Ludtke.
Available from NTIS as PB-196 659, $3.00 in paper copy, $0.95 in microfiche. Partial Technical Completion Report; Project Period: January 1, 1969 - August 1, 1969, Research Report No 29, 1970. 33 p, 3 tab, 12 fig, 19 ref, append. OWRR Project A-020-KY (2).

Descriptors: *Social change, Social aspects, *S
cial impact, *Attitudes, Social values, Kentuck
*Rural sociology, Flood control, Reservoir.
Identifiers: Human migration.

The focus is on the question of how rural peop
anticipate forced moves as a result of flood cont
projects and how they change their life accepti
separation from familiar surroundings. A model
faced migration is presented which sees the var
bles of socio-economic status, knowledge of res
voir projects, vested interests and the degree
identification with place of affected persons
producing differential apprehension over movi
Differential apprehension is then seen as produci
different attitudes toward the project which will
fluence the type of migration plans. To test t
model of forced migration, data were obtained
means of personal interview with 261 adu
located in two areas about to be flooded by m
tipurpose reservoirs. Goodman and Krusha
gamma was used as the measure of association
the ordinal data. Basic to the model were the t
findings that (1) apprehension over moving rela
inversely with people's willingness to separ
themselves from their current friends and hom
and (2) that people with favorable attitudes tow
flood control projects were less apprehensive o
moving and as a consequence were more willing
engage in moves that require greater degrees
separation from their current friends and types
residences. Other findings suggest that those p
sons whose vested interests would be enhanced
the reservoir project can be expected to engage
moves requiring the greatest amounts of so
separation. Knowledge of the reservoir project
its purposes did little to meliorate people's attitu
toward the reservoir project or to facilitate ease
moving. A new variable 'identification with pla
developed for this study, was found to re
strongly with apprehension over moving.
W71-03304

PRESENT HYDROLOGIC RESEARCH WYOMING AND FUTURE NEEDS.
Wyoming Univ., Laramie. Water Resou
Research Inst.
For primary bibliographic entry see Field 02A.
W71-03306

**INTERNATIONAL ARID LANDS C
FERENCE,**
Texas Tech Univ., Lubbock. Dept. of Agronom
H. E. Dregne.
Nature and Resources, Vol 5, No 2, p 7-12, J
1969.

Descriptors: *Water policy, *Arid lands, *C
ferences, *Social aspects, *Economics, Graz
Social impact, Education, Planning, Water all
tion (Policy), Regional analysis, Deserts, Ecol
Technology, Social needs, Economic feasibi
Economic justification, Agriculture, History
rigation, Mining, Institutions, Soils, Crops,
analysis, Mexico, Feasibility studies, Pro
planning, Political aspects, Research and deve
ment, United States, United Nations, Popula
Crop-production, Water resources.
Identifiers: *Information transfer, *Problem
ing, Australia, U.S.S.R., Israel, Africa, Asia, N
America, South America.

A central observation of this summary is the ex
sion of desert areas throughout the world bec
of human mismanagement. Existing arid areas
generally deteriorated in terms of soil, water
plant life. A major factor is overgrazing. Deve
ment plans in arid lands have usually involve
creased water supplies for augmented agricul
production. This concept of arid land develop
was challenged on several grounds. (1) Cons
tion projects receive more detailed planning
the agricultural systems they are designe
supply. (2) High intensity desert irrigation sch
require high levels of farming skills and
tenance capital. (3) Increments in per capit
come resulting from agricultural developmen
small. (4) Tourism, mining, pastoralism, low w

industry and other income-producers may be
h more desirable. Population pressures must be
viated or no progress will be possible. Sociologi-
and economic factors unique to these areas,
icularly education, have been neglected. The 3
rate major arid areas of the world are discussed
national and international means of attacking
problems are suggested. (Casey-Arizona)
-03340

-IMPOUNDMENT RECREATIONAL USE
TERN AND WATERFOWL OCCURRENCE
HE SAYLORVILLE RESERVOIR AREA,
State Water Resources Research Inst., Ames.
ld O. Haugen, and Richard E. Lenning.
lable from NTIS as PB-196 725, $3.00 in
r copy, $0.95 in microfiche. Iowa State
ersity Water Resources Research Inst.
pletion Report, June 30, 1970. 177 p, 14 fig,
b, 19 ref, 3 append. OWRR Project No A-023-
).

riptors: *Recreation, *Project planning,
ervoir design, Project purposes, Hunting, Fish-
Camping, Boating, Water resources develop-
, Water utilization, Recreation demand,
eation facilities, Land use.
ifiers: *Recreation use surveys.

eation use of the proposed Saylorville reser-
area, Iowa was studied through the use of a
ionnaire, two automatic time-lapse movie
ras, direct observation, and a pneumatic car
c-counter. Results from 436 completed
ionnaires indicated that fishing, motorcycling,
ng, boating and camping were the first
rred choices of outdoor recreation. Many
e had no second, third, or fourth choices of
rred activity. Camping, fishing, boating, mo-
cling, and canoeing, respectively, showed
st observed totals of participant-hours of ac-
Seventy-six percent of all respondents (332)
ated their visits occurred on weekends. Peak
ers of people were sighted from 4 to 7 p.m.
of traffic activity were observed from 3 to 5
Flat-bottomed fishing boats were the most
ion river craft. Almost 87% of all waterfowl
the Des Moines River in the Saylorville area
g the 2 years of the study were observed dur-
ring migration in 1969. (Knapp-USGS)
03373

CEEDINGS MISSISSIPPI WATER
URCES CONFERENCE, 1970.
sippi State Univ., State College. Water
rces Research Inst.
imary bibliographic entry see Field 04A.
03380

RT ON WATER AND WASTE WATER
BROWARD COUNTY, FLORIDA.
tes of Florida, Inc., Miami. Broward County
Planning Board, Fort Lauderdale, Fla.
imary bibliographic entry see Field 05D.
03532

DISUTILITY OF UNCERTAIN LOSSES,
rs - The State Univ., New Brunswick, N.J.
Resources Research Inst.
m Whipple, Jr.
eering Economist, Vol 16, No 1, p 43-57,
y 1971. 2 tab, 1 fig, 19 ref.

ptors: *Economics, *Benefits, *Risks, Cost-
t analysis.
iers: *Uncertainty, *Disutility of uncertain
*Utility function, Utility.

ncient hypothesis that equal quantities of
gained or lost have different utilities de-
g upon the circumstances of the recipient
ver been fully accepted into the main body of
mic theory. To eliminate confusion, it is es-
to abandon the attempt to quantify a utility
n of wealth or income, and to develop in-
stead a utility function of uncertain gains contin-guencies by the same individuals. The basic facts of life insurance and health insurance show that the majority of persons are prepared to pay approximately twice the actuarial value to avoid major contingencies. These results allow definition of a marginal utility coefficient for this range of losses. Small losses and moderate gains apparently have utility coefficients approximating unity. A working hypothesis based upon the above is consistent with evidence as to risk aversion from the securities markets. The most important characteristic of the utility function is a high disutility of major unexpected losses, which is disproportionate to the marginal utility of gains or losses under ordinary circumstances. Application of the above conclusions provides a rational basis for an additonal component of flood control benefit in some cases, and should help to clarify what has been considered an anomaly in the opportunity-cost theories of social discount rate. (Whipple-Rutgers)
W71-03591

ANNUAL REPORT 1970 DELAWARE RIVER BASIN COMMISSION.
Delaware River Basin Commission, Trenton, N.J.

Delaware River Basin Commission, Box 360, Treton, New Jersey 08603, 1970. 60 p.

Descriptors: Water quality control, Estuaries, Environment, Waste treatment, Water quality, *Delaware River, *Delaware River Basin Commission.
Identifiers: *Regional water quality administration, *Regional sewerage system, *Pollution abatement schedules.

This annual report of the DRBC contains certain items of considerable economic importance. Proposals have been made by a group of large oil companies for a large off shore loading terminal in the lower end of the Delaware estuary, in order to accommodate super tankers. This apparently feasible project (on an economic basis) has been suspended as part of a general freeze on coast line developments by the governors of New Jersey and Delaware, in the interest of environment protection. Pollution abatement schedules have been worked out with 41 large municipal and industrial waste dischargers. Generally schedules require full compliance by 1973; but the city of Philadelphia has been given more time, since in that case compliance will require expenditures of $75 million. To serve some 30 miles of shoreline on the New Jersey side of the estuary, a regional waste treatment system is proposed. A dozen participating municipal and industrial dischargers are sharing the $1.3 million cost of a pilot plant study, which has shown that 90% effectiveness in treating the combined wastes could be achieved. (Whipple-Rutgers)
W71-03592

LECTURES ON WATER MANAGEMENT.
Dept. of Environmental Engineering Science. Johns Hopkins Univ., Baltimore, Md.

Water Management Seminar, October 1964-May 1965. Johns Hopkins University, Baltimore. 352 p.

Descriptors: *Water management (Applied), Economics, Water utilization, Water resources development, Political aspects, Water law, California, Maryland, United States.
Identifiers: Canada.

This series of twenty-four lectures covered a wide scope of topics focusing on uses of water resources and their development and management. Water resources law and politics as well as the economics of water resource development and use were dealt with by several authors. Specifically mentioned were brief case studies of the California Water Plan, the Maryland Water Supply Study and Canada - U.S. international water problems. Appropriate portions of the publication are forwarded with abstracts of those portions. (See also W71-03595 thru W71-03596) (Holmes-Rutgers)
W71-03594

FUNCTIONAL EVALUATION OF A WATER RESOURCES SYSTEM,
For primary bibliographic entry see Field 06A.
W71-03598

WATER TRANSFERS: ECONOMIC EFFICIENCY AND ALTERNATIVE INSTITUTIONS,
Colorado State Univ., Fort Collins; and Calgary Univ. (Alberta).
L. M. Hartman, and Don Seastone.
Baltimore, Johns Hopkins Press, 1970. 127 p.

Descriptors: *Water transfers, *Economic efficiency, *Water law, Economic evaluation, Water supply, Districts, Computers, Water resource allocation, Income, Taxes, Government, Prices, Costs, Spillover, Irrigation, Water use.
Identifiers: *Externalities, Colorado, New Mexico, Income effects, Water institutions.

The extent is examined to which existing organizational arrangements for the management of water resources permit reallocations to take place efficiently. The study centers on the analysis of externalities and water law. The relation between diversion and consumptive use of water transfers creates a common externality. The effect on the supply of resources to third parties is analyzed along with the conditions required for efficient transfers of water. The study also presents a comparative analysis of the performance of the Colorado and New Mexico legal systems for regulating water transfers. Other chapters report on typical organizational forms, namely, the ditch company and two different water conservancy districts. A theoretical discussion of the income interdependency effect in water transfers between communities is presented and in the concluding chapter some estimates of this effect are computed. (Murphy-Rutgers)
W71-03601

STRATEGIES OF AMERICAN WATER MANAGEMENT,
Chicago Univ., Ill.
Gilbert F. White.
Ann Arbor, University of Michigan Press, 1969. 149 p.

Descriptors: *Water management, *Water supply, *Planning, Irrigation, Multiple purpose projects, Floods, Municipal water, Water demand, Economic evaluation, Drainage basins, Dams, Hydropower, Regional analysis, Technology, Water quality, Costs.
Identifiers: *Multiple means, *Regional integration, *Single purpose projects.

Different ways are examined in which water is and has been managed for the purpose of finding more suitable ends and means of manipulating the natural water system. The first chapter outlines a framework in which a society's water management decisions may be examined. The remainder of the book is devoted to the major strategies which have been practiced in the United States. Of these, single purpose construction is the oldest and most widespread water management strategy and the author explains how the decisions of this technique are made. This concept has developed into multiple purpose projects and multiple means. The author discusses the problems and possible solutions of determining public preferences in addition to considering the role of research in water management. The concluding chapter deals with the water management strategy of regional integration. A method of planning is developed for a metropolitan area or group of drainage basins which continually explores multiple means of reaching multiple ends. (Murphy-Rutgers)
W71-03602

WATER RESOURCE ALLOCATION, EXTRA MARKET VALUES, AND MARKET CRITERIA: A SUGGESTED APPROACH,
Oregon State Univ., Corvallis.
Emery N. Castle, and Herbert H. Stoevener.
Natural Resources Journal, Vol 10, No 3, p 532-544, July 1970.

Descriptors: *Water resource allocation, *Market value, Economic evaluation, Operations research, Cost-benefit analysis, Water pollution.
Identifiers: *Public good, Externalities, Indivisibility, Consumer surplus.

The role of the market is discussed in generating information for decision makers concerned with extra-market problems. For water resources, the market has been modified or eliminated as a means of resource allocation. The reasons for the development of alternatives to the market for water resource allocation stem from a number of sources including the existence of technological interdependencies, indivisibility and the existence of water as a public good. Even when the market may fail, the logic of resource allocation which is a part of market price theory can be very valuable in the creation and the evaluation of market alternatives. The society evaluates returns relative to costs in deciding the optimal level of use. One alternative with respect to water pollution is that polluters should be charged a fee per unit for waste discharge which is economically efficient. The second example is wide scale water diversion. Operations research techniques have been used to consider possible alternatives while simulating market operations. The final example given is for outdoor recreation where research is directed one more toward simulating market criteria. (Siegenthaler-Rutgers)
W71-03603

WATER QUALITY ENVIRONMENT AS RELATED TO INDUSTRY,
Great Western Sugar Co., Denver, Colo.
Lloyd T. Jensen.
In: Man and the Quality of His Environment, Boulder, University of Colorado Press, 1968, p 59-65.

Descriptors: *Water quality, *Industrial water, *Industrial wastes, Municipal water, Prices, Costs, Water demand, Treatment costs, Pollution, Government, Taxes, Population.
Identifiers: *Great Western Sugar Company.

The importance is outlined of adequate water resources to industrial enterprizes as well as the nature of industrial water use. This need for good quality water is often in conflict with the needs of other water users and the problems of this divergence are discussed. As an example of an effective industrial program the author explains the situation of the Great Western Sugar Company which involves in-plant control of wastes, then moves to by-product recovery, then reuse, then recycling and finally treatment. There are a number of different alternatives available for water quality management which involve different prices for water due to different treatment costs. Meeting future water needs will necessitate a considerable amount of planning and will be extremely costly. (Murphy-Rutgers)
W71-03604

ECONOMIC FRAMEWORK AND ASSOCIATED BASIC STUDIES,
Department of the Interior, Atlanta, Ga.
Ned L. Williams.
In: Organization and Methodology For River Basin Planning, Atlanta, Georgia, Georgia Institute of Technology, 1964, p 157-185.

Descriptors: *Water resource development, *Economic evaluation, *Planning, Government, Water law, Financing, Transportation, Regional analysis, Costs, Land use, Population, Investment, Agriculture, Water supply, Prices, Hydropower, River basins.
Identifiers: *USSC, *SERB, Econometrics, Economic studies, Migration.

The basic economic studies of the U. S. Study Commission (USSC) for the Southeast River Basins (SERB) are discussed. These studies described the present level and past trends of the SERB area and the national economy, the projected level of the economy and related growth factors, and the requirements for resource developments in a form suitable for planning future resource development programs. The paper also makes mention of other studies which provide needed insight into such considerations as water law, financing, transportation and migration. The author devotes a section to the staff organization as related to the acquisition, evaluation, presentation and use of the economic studies. The methodology of the studies is examined and the concluding section discusses the more unique, distinctive and experimental aspects of the studies. (Murphy-Rutgers)
W71-03605

ECONOMIC FACTORS AFFECTING SYSTEM DESIGN,
Harvard Univ., Cambridge, Mass.
Stephen A. Marglin.
In: Design of Water Resource Systems, Cambridge, Harvard University Press, 1962, p 159-225.

Descriptors: *Water resources development, *Budgets, *Optimization, *Investment, *Economic evaluation, Costs, Government, Benefits, Time, Rate of discount, Interest rate, Water supply, Mathematical studies, Water demand, Planning, Prices.
Identifiers: *Water system design, Opportunity costs, Present value.

The economic factors effecting the objectives and concepts of water system design are examined. This paper provides an analysis of the influence of the budgetary constraint, in various forms, on the optimal system design. The problems raised for system design by the dynamic nature of the investment process are treated. Since costs and benefits occur in time streams, the objective is to obtain the optimal investment schedule as well as design for system units. The choice of interest rates for public investment in water resource development is discussed and a method by which the opportunity costs of public investment can be calculated in a mixed private-public economy is provided. In the last section certain problems raised by specific external alternatives to water-resource systems are examined. (Murphy-Rutgers)
W71-03606

WATER POLLUTION CONTROL AND ABATEMENT.
Iowa State Univ., Ames; Iowa Univ., Iowa City.
For primary bibliographic entry see Field 05G.
W71-03610

SCOPE AND CHALLENGE OF THE WATER POLLUTION SITUATION,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-03611

ECONOMICS OF WATER QUALITY,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 05G.
W71-03612

PUBLIC ECONOMICS,
Stanford Univ., Palo Alto, Calif.; Paris Univ., (France).
J. Margolis, and H. Guitton.
London, Macmillan, 1969. 574 p.

Descriptors: *Resource allocation, Risk, Optimization, Economic efficiency, Public administration, Welfare economics.
Identifiers: *Public goods, *Pareto criteria, Equity, Social objective function.

This book presents the papers given at a 1966 conference on Public Economics. These papers present an analysis of public production and consumption and their relations to the private sector. The central theme is the economic analysis of the public sector. The papers deal with the extension of economic theory to the public sector, the pricing and investment behavior of public enterprises and rules for their efficient operation, economic issues within public administration, and the public enterprise in a socialist setting. The economic theory papers discuss the theory of public goods and the problems of supplying the optimal amount of these services. Distributional aspects were analyzed to satisfy equity as well as efficiency conditions. The papers on pricing demonstrate that the marginal cost pricing rule is too unsophisticated to deal with the complex public enterprise. This book is relevant for water planners concerned with public goods theory and the implications of this theory for decision making criteria and resource allocation. (See also W71-03617 thru W71-03620) (Siegenthaler-Rutgers)
W71-03616

RISK TAKING AND RESOURCE ALLOCATION,
Institut National de la Statistique et des Etudes Economiques, Paris (France).
E. Malinvaud.
In: Public Economics, London, Macmillan, 1969, p 222-246.

Descriptors: *Risk, Resource allocation, Public decision, Welfare economics, Probability distribution.
Identifiers: *Risk aversion, Net benefit, Technical constraint, Pareto optimum, Social utility function, Present value, Capital market, Contingent goods.

The effect of risk on public decisions is discussed. The presence of risk affects the social objective to be assigned to the public allocation of resources. The social objective or norm is the maximum of the social consumption plans. The author contends that the social ethic implies that collective choices exhibit risk aversion. He then considers how risk is included in the economic calculation preceding public decision-making. Risk constitutes an extra cost and can be included through increases in the discount rate or in a security margin which increases expected costs for large risks. The result is that uncertain operations must be reduced in favor of super operations if both operations produce the same commodities but not necessarily if they produce different outputs. Public policies toward risk-taking should have three purposes: to eliminate the individual risks affecting firm management but not the community; to reduce discrepancies among evaluations of the same risks by private firms; and to ensure that private attitudes agree with social attitudes. Suggestions for future research are offered on the level of risk aversion implied for firms by the social utility function and on risk aversion. This article is relevant for water planners concerned with the role of risk in investment decision-making theory. (See also W71-03616) (Siegenthaler-Rutgers)
W71-03617

GENERAL EQUILIBRIUM WITH PUBLIC GOODS,
California Univ., Berkeley.
R. Dorfman.
In: Public Economics, London, Macmillan, 1969, p 247-275.

Descriptors: *Welfare economics, *Decision making, Marginal cost, Political constraint, Budget constraint, Net benefit, Marginal utility.
Identifiers: *General equilibrium, *Public goods, Externality, User charge, Convexity, Tax burden, Objective function, Willingness-to-pay, Citizen, Surplus, Concave programming, Shadow-pricing,

ome redistribution, Consumer surplus, Social welre function.

ublic goods are ordinary economic goods except at their use can not be rationed nor can their enefits be allocated. Decisions about public goods e made socially or politically. The approach is to e a general equilibrium model to which a governent sector has been added. The model assumes ly socio-economic groups have preference maps r public goods. The process of gaining public acptance for government proposals involves the rsuasion of political leaders who then convey the ogram to their following. The model is formuted as a concave programming problem approxiating government behavior given preferences, essures and prices. The approach is that of llingness-to-pay with the government providing vels of public goods and the citizen's surplus ual to the excess of his gross benefit over the inease in taxation or burden necessitated by the ineased public good consumption. It is argued that ere is a price vector used by the government ich brings general equilibrium in the economy. ccordingly, the level of public goods will be chnically efficient. The model allows the general uilibrium theory apparatus to be used for idance in public goods decisions and indicates e social losses occurring when decisions are not egrated with tax and expenditure policy. This arle is relevant to water research activities due to development of an explicit government sector o conventional economic models. (See also 71-03616) (Siegenthaler-Rutgers)
71-03619

ULTIPLE USE DECISION MAKING--WHERE O WE GO FROM HERE,
ah State Univ., Logan.
S. Whaley.
tural Resources Journal, Vol 10, No 3, p 557-5, July 1970.

scriptors: Resource allocation, *Decision mak-, Uncertainty, Economic evaluation, Costnefit analysis, Linear programming.
ntifiers: *Multi-product, *Social cost, Technical nopoly, Public welfare, Internal rate of return, nsumer surplus.

e problem of making multiple use resource alloion decisions in the particular case of public ds is considered. When resources are publicly ned, the price system is no longer used to alate these resources. As a result, there is a lack of a on the market value of a product which makes ision making difficult. A popular approach to lic investment decision making is to evaluate difference (or ratios) between benefits and ts. However, the difficulty of assigning quantitae measures to benefits derived from non-market plied goods and services has made the applicaof benefit-cost analysis difficult (an example ng the pricing of water for recreation and nestic use). Recent research is devoted to plac- a dollar valuation on non-market supplied urces. Such methods of valuation as consumer plus, monopoly market value and cost have ited success when the values are used in urce allocation models. The author suggests a ader orientation to the multiple use problem. e market valuation system is not sufficient. First, urce management goals must be set and only n should valuation systems for benefit measurent be formulated. (Siegenthaler-Rutgers)
1-03624

OCEEDINGS OF THE FOURTH AMERICAN TER RESOURCES CONFERENCE.
logical Survey, Mineola, N.Y.

American Water Resources Conference, Comdore Hotel, New York, November 18-22, 1968, Anne, Illinois, Record Press, 1968. 793 p.

scriptors: *Water resource development, ater supply, *Pollution, City planning, Municipal water supply, Cities, Aquifers, Water management, Floods, Sewers, Storm runoff, Waste water, Water quality, Economic aspects, Regional analysis, Pollution, Droughts, Water resources research, River basins, Erosion, Meteorology.
Identifiers: New York, Chicago, Wisconsin, Metropolitan area problems.

Papers were presented on the interdisciplinary interests of the participants in the fields of water-resources research, planning, development, management and education. Particular concentration was focused on metropolitan area water problems. The fifteen sessions were concerned with the water resource problems of the cities, storm runoff and waste water disposal, the economics of pollution and quality of the environment, regional water planning, super projects, flood control and flood plain management, citizen action and the problems of pollution and pollution control. Also discussed were the areas of: groundwater in the urban environment, international water-resource programs, general water resources research, droughts and other meteorological considerations, urban water resources research, and national and local water policy. The problems were analyzed critically from several aspects with suggestion of possible solutions. (See also W71-03626 thru W71-03627) (Murphy-Rutgers)
W71-03625

READINGS IN RESOURCE MANAGEMENT AND CONSERVATION.
Toronto Univ., (Ontario); and Clark Univ., Worcester, Mass.

Edited by Sam Burton, and Robert W. Kates. Chicago, University of Chicago Press, 1965. 609 p.

Descriptors: *Natural resources, *Conservation, Population, Costs, Government, Economic evaluation, Geography, Land use, Technology, Farms, Resource allocation, Social aspects, Systems analysis, Agriculture, Water resource development, Decision-making, Economic analysis, Economic efficiency, Regional analysis.
Identifiers: Economic development.

This is a collection of papers which seek to explore some of the problems of resource management and conservation. The relationship between population and the resource limits of the earth is discussed followed by chapters describing the growth of the concept of conservation and the various social, economic and ethical factors involved. The following chapter contains a number of case studies dealing with problems involved in the area of natural resource management. Next to be examined is the relationship between natural resources and the economic growth of regions and countries. The effect upon resource management and conservation of scientific and technological change is then discussed. The concluding chapter contains a number of papers on various systems methods designed to evaluate the choice of relevant alternatives for natural resource development. Although concerned with all natural resources, the book contains numerous papers dealing specifically with water resources as well as papers whose conclusions are applicable to this area. (See also W71-03632 thru W71-03643) (Murphy-Rutgers)
W71-03631

THE COLUMBIA BASIN PROJECT: EXPECTATIONS, REALIZATIONS, IMPLICATIONS,
Delaware Univ., Newark.
George Macinko.
In: Readings In Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 289-297.

Descriptors: *Water resource development, *Columbia River Basin, *Planning, *Economic justification, River basins, Government, Irrigation, Land use, Dry farming, Costs, Technology, Budgets, Government supports, Demand.
Identifiers: *Columbia Basin Project, Time lag.

The author believes that the problems which have caused a halt in the development of the Columbia Basin Project are of a nature common to other water resource projects. He attempts to provide an overview of this Project in order to indicate what future developments can be expected in the field of reclamation. The author discusses the problems arising from the time lag between planning and implementation, overruning the project costs, increases in farm size and their relation to government subsidies, and changes in land use patterns. There is a need for greater flexibility in programming, closer atunement to the state of the national economy, reduction in lag time, and new economic analysis to justify reclamation development in the face of competing demands on the nation's water resources. (See also W71-03631) (Murphy-Rutgers)
W71-03633

CONNECTIONS BETWEEN NATURAL RESOURCES AND ECONOMIC GROWTH,
Chicago Univ., Ill.
Theodore W. Schultz.
In: Readings In Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 397-403.

Descriptors: *Economic impact, *Natural resources, Productivity, Capital, Labor, Rate of return, Economic evaluation, Supply, Prices, Land use, Costs, Technology, Equilibrium, Investment.
Identifiers: *Economic growth, Primary production, Reproducible capital, Diminishing returns.

The author wishes to discover the connections between natural resources and economic growth and to dispense with the prevailing misconceptions in this area. The author's orientation is towards a theory concerning all natural resources and the economic growth of a country. However, the conclusions are readily applicable to water resources in particular and the specific water-related factors effecting regional economic growth. The paper examines the value of natural resources as a factor of production and dismisses as inadequate the view of that role originating from both the classical and Harrodian analysis. The author then investigates the contribution that natural resources can make to economic growth and finds that whether or not new forms of capital are adaptable to primary production is of vital importance in determining the role of natural resources. The article concludes by illuminating the connections between natural resources and reproducible non-human capital and the labor force. (See also W71-03631) (Murphy-Rutgers)
W71-03635

A GUIDE TO BENEFIT-COST ANALYSIS,
Chicago Univ., Ill.; British Columbia Univ., Vancouver; and Canada Advisory Committee on Water Use Policy, Ottawa (Ontario).
WRD Sewell, AD Scott, DW Ross, and John Davis.
In: Readings in Resources Management and Conservation, Chicago, University of Chicago Press, 1965, p 544-557.

Descriptors: *Benefit-cost analysis, *Economic evaluation, Investment, Rate of return, Economic justification, Project planning, Measurement, Joint costs, Decision-making, Optimization.
Identifiers: *Externalities, Sunk costs, Intangible benefits.

Benefit-cost analysis is able to provide a logical framework for the evaluation of one or more courses of action in the area of water resourse development. The authors attempt to provide a guide to the proper use of benefit cost analysis in this area. The different purposes for which benefit-cost analysis may be used are explained and exact definitions of the terms commonly employed are provided. The principles upon which benefit-cost analysis is based are given followed by an explanation of true economic cost. The results of benefit-cost analysis may differ according to the viewpoint of the evaluator. Accordingly, this viewpoint should be

clearly stated. The optimum scale for a given development occurs at a point where its net benefits are at a maximum but economic comparisons among projects may be made by: comparisons of net benefits, comparisons of rates of return, or comparisons on the basis of benefit-cost ratios. These different methods are explained and in the final section the interdependence of projects is discussed. (See also W71-03631) (Murphy-Rutgers)
W71-03636

MALTHUSIANISM AND CONSERVATION: THEIR ROLE AS ORIGINS OF THE DOCTRINE OF INCREASING ECONOMIC SCARCITY OF NATURAL RESOURCES,
Washington Univ., St. Louis, Mo.
Harold Barnett.
In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 204-226.

Descriptors: *Natural resource development, *Conservation, *Economic efficiency, *Pollution, Wastes, Streams, Costs, Dams, Balance of nature, Hydroelectric power, Technology, Population.
Identifiers: *Malthus, Economic scarcity, Unearned increment, Diminishing returns, Economic growth.

This article deals with the economic scarcity of natural resources relative to population and goods consumption. The basic theories of Malthus on this problem are used to construct modern economic models of the relation between natural resources and economic growth. Both a static and a growth model result from the incorporation of strategic variables. Time horizons, rate of population increase, natural resources available, technology and institutions, and the law of diminishing returns are the five constraints included to insure Malthusian results. These Malthusian projections are then juxtaposed with the views of the contemporary conservationists. The former are most concerned with quality, rather than quantity, of available natural resources. In this capacity, interest has arisen in water pollution, soil conservation, and air pollution. The conservationists plead for the wise use of resources and the avoidance of waste for the purpose of promoting economic well-being. The problem of resource scarcity is particularly acute in the area of water resources, making this article of interest to the water researcher. (See also W71-03631) (Murphy-Rutgers)
W71-03637

POPULATION AND NATURAL RESOURCES,
Carnegie Institution of Washington, D.C.
For primary bibliographic entry see Field 06D.
W71-03638

WHAT IS CONSERVATION,
Resources for the Future, Inc. Washington, D.C.
Orris C. Herfindahl.
In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 229-236.

Descriptors: *Conservation, *Natural resource development, *Water use, Dams, Lakes, Minerals, Forests, Irrigation, Water supply, Costs, Benefits, Streams, Fishing, Recreation, Industrial water use.
Identifiers: *Pinchot, Wildlife refuge, Private market system, Import limitation.

This article deals with the imprecision surrounding use of the word conservation. The author first treats Pinchot's definition of conservation as the use of natural resources for the greatest good of the greatest number for the longest time. Also handled is Pinchot's premise that conservation implies both the development and protection of natural resources. The author challenges the possible coexistence of these two objectives, citing as an example, the construction of a dam which necessarily interferes with the preservation of the environment's natural beauty. Conflict between varying interest groups is blamed for the preservation of Pinchot's lack of clarity in the writings of contemporary conservationists. The dam type of controversy is not the only conflict. Various types of development are also opposed to each other, such as irrigation and urban water supply. To solve these definitional problems, conservation can be regarded as a means of maximizing the return from all resources at the disposal of society. It is pointed out that in all such conservation measures, the benefits must outweigh the costs to ensure economic feasibility. Since water resources conservation is an important part of the total conservation effort, this article should be of interest to the water researcher. (See also W71-03631) (Murphy-Rutgers)
W71-03639

WORLD RESOURCES AND TECHNOLOGY,
London Univ. (England).
For primary bibliographic entry see Field 06E.
W71-03640

WELFARE, ECONOMICS AND RESOURCE DEVELOPMENT,
Indiana Univ., Bloomington.
J. W. Milliman.
In: Readings In Resource Management and Conservation, Chicago, University of Chicago Press, p 284-288, 1965.

Descriptors: *Water supply, *Economic evaluation, *Economic efficiency, Water demand, Prices, Elasticity of demand, Water law, Investment, Water resource development, Government, Cost-benefit analysis, Water rights, Rate of discount.
Identifiers: *Water subsidies, *Project analysis.

Conclusions and highlights are presented of a water supply study recently completed. The study was divided into the examination of the allocation of existing water supplies and a study of the alternatives for developing new supplies. They found that water supplies were grossly misallocated among and between uses and it is these misallocations which lead to claims of water shortage. The authors also believe that major water investments in the United States are typically undertaken prematurely and on an over ambitious scale. Some of the reasons for the resulting over investment in water supply are given as: the failure to adjust prices for the purpose of changing demand and the biases inherent in conventional techniques of project analysis. In conclusion, the author states that increased application of economic principles will produce greater efficiency in water supply in relation to all the other desires of the community. (See also W71-03631) (Murphy-Rutgers)
W71-03641

RATIONAL CHOICE IN WATER RESOURCES PLANNING,
Stanford Univ., Calif.
Hubert Marshall.
In: Readings In Resource Management and Conservation, Chicago, University of Chicago Press, p 529-543, 1965.

Descriptors: *Decision-making, *Economic evaluation, *Planning, *Water resources development, Economic analysis, Costs, Benefits, Interest rate, Government, Financing, Economic efficiency, Social aspects, Floods.
Identifiers: *Rational choice, *Relevant alternatives, Organizational loyalty, Professionalization, Countervailing power, Congress, Bureaucracy.

In order to assure a proper allocation of resources, rational choice in the water resources area is essential. This requires a number of correct actions. The economic evaluation of water resource project benefits have been of inferior quality causing a great deal of misinformation. The use of an appropriate interest rate is vitally necessary but the present practices fail to consider alternatives to the government cost of borrowing. The jurisdictional jealousies of the several construction agencies act as a force preventing the consideration of relevant alternatives which may result in a higher benefit cost ratio. The author also discusses various institutional arrangements which make rational decision all but impossible in the water development field. Included here is: the absence of countervailing powers, the disadvantages arising from our representative form of government, and individual loyalty to the agency organization. In the final section the author deals with the professionalization of economists in government service and shifts in the location of the decision making authority in the national government as possible solutions to the problem. (See also W71-03631) (Murphy-Rutgers)
W71-03642

NATURAL RESOURCE ENDOWMENT AND REGIONAL ECONOMIC GROWTH,
Resources for the Future, Inc., Washington, D.C.
Harvey S. Perloff, and Lowdon Wingo.
In: Readings In Resource Management and Conservation, Chicago, University of Chicago Press, p 427-442, 1965.

Descriptors: *Natural resources, *Regional analysis, Technology, Economic analysis, Industrial production, Agriculture, Income, Demand, Population.
Identifiers: *Resource endowment, *Economic growth, Heartland-hinterland, *Cumulative advantage.

An adequate water supply is a vital parameter in determining the economic future of an area. This paper is concerned with the relationship between the natural resources (including the water resources) of a region and the nature of economic expansion. The authors find that resource endowment is continuously redefined by changes in final and intermediate demand, production technology and economic organization. The relative economic growth of a region is directly related to its relative advantages in the production of goods and services for the national market. The working out of cumulative advantage is exhibited in the specialized role which a region plays in the national economy, and this specialized role can best be described in terms of the heartland-hinterland relationships. (See also W71-03631) (Murphy-Rutgers)
W71-03643

TECHNIQUES OF PROJECT APPRAISAL,
Chicago Univ., Ill.
Arnold Harberger.
In: National Economic Planning, New York, Columbia University Press, p 131-149, 1967.

Descriptors: *Decision-making, Risk, Cost-benefit analysis, Marginal productivity, Discount rate, Demand function.
Identifiers: *Project appraisal, *Shadow prices, Time path, Capital market, New benefit, Externalities, Opportunity cost.

The effect of uncertainty on project appraisals is considered. In particular, the focus is primarily on the implications of changes in the discount rate for decision-making and cost-benefit analysis. The author rejects the argument that private investors excessively discount the future on grounds of risk. He recommends the observed past average social rate of return to capital as the best approximation of the discount rate for cost-benefit analysis. This advice is based on the assumption that relevant long term future rate of discount can be assumed constant and near the historical average, a finding useful for decision-makers. When market prices do not reflect the scarcity value of inputs, shadow prices are used. The use of a shadow price below the market price results in a much higher shadow rate of return to capital than the market rate and hence excessively high discount rates for future projects. The author cautions against the use of low or near zero shadow prices to avoid this problem.

his article provides a comprehensive discussion of iscount rate issues in public investment projects nd should prove valuable to water investment stuies. (Siegenthaler-Rutgers)
/71-03646

HE PLANNING PROGRAMMING-BUDGET-NG APPROACH TO GOVERNMENT DECI-ION-MAKING,
attelle Memorial Inst., Columbus, Ohio.
arold A. Hovey.
ew York, Frederick A. Praeger, 1968. 264 p.

escriptors: *Decision-making, *Cost-benefit alysis, Program budgeting, Resource allocation, conomic efficiency, Constraint, Marginal cost, Interest rate.
entifiers: *Planning-Programming-Budgeting, System cost, Opportunity cost, Cost-effectiveness, xternalities, Subsidies, Income redistribution, onsumer surplus, User charge, Shadow pricing.

his book presents the basic elements of the anning-Programming-Budgeting (PPB) approach decision-making. Under the PPB approach, both e budget and the program can be organized on e basis of program categories reflecting valued tputs of government programs permitting decion-makers to consider all costs in relation to the rpose pursued by government. The author scusses the identification of program goals, cost easurement, cost-effectiveness and cost-benefit alysis. Examples were presented to show that PB can expose important issues and thereby imove information available to the political decion-maker. The problems connected with PPB of th a conceptual and operational nature were scussed. The author concludes that if PPB is supted and implemented by Congress and Administors, it will be possible to effect major improveents in government planning and budgeting. The ok is relevant for water resource planners conned with program budgeting and the economic aluation of both existing and planned projects. iegenthaler-Rutgers)
71-03648

CONOMIC ANALYSIS OF PUBLIC INVEST-ENT DECISIONS: INTEREST RATE POLICY ND DISCOUNTING ANALYSIS.
nt Committee on Economics (U.S. Congress).

arings before the Subcommittee on Economy in vernment of the Joint Economic Committee, netieth Congress, July 30, 31, and August 1, 68. Washington, U. S. Government Printing Ofe, 1968. 193 p.

scriptors: *Discount rate, *Interest rate, *Decin making, Cost-benefit analysis, Economic effincy, Risk, Uncertainty, Economic evaluation, lation, Resource allocation.
ntifiers: *Public investment, *Social rate of inest, Capital rationing, Capital market, Two-part cing, Opportunity cost.

e objective of these hearings was to consider the nomic evaluation of public investment and to ablish a conceptual framework for Government erest rate policy. On the basis of this concept, committee desired to establish an accurate asure of the interest rate to be used for governnt projects. Witnesses from Government agens and academia provided testimony on this subt. Government discounting practices were deterned to be neither consistent nor appropriate. en imperfect capital markets, a range of conts were offered as the appropriate public count rate including the social rate of time ference, the cost to the Treasury of borrowing, opportunity cost of displaced spending meaed by the opportunity cost of return on investnt or tax-financed investment. The sub-committ recommended that no public investment be med efficient or economic if it fails to yield erall benefits as large as the same resources in private sector. The Committee, furthermore, stressed the need for research on the opportunity cost of private spending displaced by Government investment. The cost of the noneconomic impact of public spending must be recognized as well in order that accurate evaluation of the real national economic impact can be made. This study is important for water planners concerned with the economic evaluation process of investment decisions. (See also W71-03650 thru W71-03651) (Siegenthaler-Rutgers)
W71-03649

INTEREST RATE POLICY FOR THE EVALUATION OF FEDERAL PROGRAMS,
Harvard Univ., Cambridge, Mass.
Otto Eckstein.
In: Economic Analysis of Public Investment Decisions: Interest Rate Policy and Discounting Analysis, Hearings of the Joint Economic Committee, July 30, 31, and August 1, 1968, Washington, Government Printing Office, p 50-56, 1968.

Descriptors: *Interest rate, *Economic efficiency, Economic evaluation, Investment decision, Risk, Cost-benefit analysis.
Identifiers: *Capital market, *Rate of return, Capital intensity, Liquidity, Social rate of time preference.

Interest rate policy for decision-making in the public sector is discussed. Interest rates which are below optimal levels result in excessive capital intensity and scale of development. With imperfect capital markets, the author considers the social rate of time preference and the opportunity cost of public capital as means of solving the interest rate problem in the public sector. A theoretical solution to the problem is given by first applying the social time preference rate of interest on project valuation, and then computing the cost-benefit ratio of foregone opportunities in the public and private sector. Projects are undertaken that have a cost-benefit ratio greater than the ratio of foregone opportunities. This method is difficult to apply since there is no accepted empirical definition of social time preference. The author feels a correct method is to use an opportunity cost estimate based on tax financing which results in a higher interest rate than a borrowing concept and is more realistic vis-a-vis the capital market. This article is important for water studies involved with the efficient utilization of government water investment expenditures. (See also W71-03649) (Siegenthaler-Rutgers)
W71-03650

CONTRAST BETWEEN WELFARE CONDITIONS FOR JOINT SUPPLY AND FOR PUBLIC GOODS,
Massachusetts Inst. of Tech., Cambridge.
Paul A. Samuelson.
Review of Economics and Statistics Vol 51, No 1, p 26-30, February 1969.

Descriptors: *Welfare economics, *Social aspects, Economic efficiency, Government, Optimization, Decision making, Marginal cost, Demand, Mathematical study, Costs, Economic evaluation.
Identifiers: *Public goods, Marginal utility, Production functions.

The author feels that for joint products, as the number of persons on both sides of the market increases, there is convergence in the usual fashion to the conditions of perfect competition. However, when the number of persons is increased in the case of a typical public good the problem becomes more indeterminate. The author attempts to provide a statement in terms of modern welfare economics of the various optimality conditions as they appear in the case of joint products. Certain aspects of water resources are commonly classified as a public good and analyzed as a good in joint supply. The paper shows that if the production functions satisfy the strict returns conditions conducive to perfect competition, the market place will determine the optimal resource allocation. Thus, the author concludes, there are real demand functions involved in standard joint products. The conclusion represents an intrinsic contrast to the public good case. The general theoretical public good arguments of this paper together with the use of flood control examples makes this article relevant to the water research area. (Murphy-Rutgers)
W71-03652

NATIONAL ECONOMIC PLANNING,
Massachusetts Inst. of Tech., Cambridge.
Max F. Millikan.
New York, Columbia University Press, 1967. 413 p.

Descriptors: *Economic planning, Resource allocation, Economic evaluation, Optimization, Input-output-analysis.
Identifiers: *Public expenditure, *Public good, Locational choice, Project appraisal, Objective function, Externalities, Sensitivity analysis.

This book is the result of a conference held on national economic planning. The focus is the analytic tools being utilized by economists in the planning process in countries at different stages of growth and degrees of centralization in decision-making. The first set of papers deal with functional problems common to planning. The second set of papers deals with the technique of planning in different countries. The functional issues considered were locational choice, techniques of project appraisal, and the planning of public expenditure. The question of whether planning models are useful to decision-makers was considered. The problems of restrictive assumptions, inadequacy of data, and multiplicity of goals were stressed. This book is relevant for water resource planners concerned with the economic evaluation of particular projects and the relationship to the overall government planning role. (Siegenthaler-Rutgers)
W71-03653

THE INTEGRATION OF EQUITY AND EFFICIENCY CRITERIA IN PUBLIC PROJECT SELECTION,
Maryland Univ., College Park; and Urban Inst., Washington, D.C.
Martin C. McGuire, and Harvey A. Garn.
Economic Journal, Vol 79, No 316, p 882-893, December 1969.

Descriptors: *Economic efficiency, Cost-benefit ratio, Public project planning, Regional development, Budget constraint.
Identifiers: *Equity, Economic welfare, Welfare index, Payoff, Objective function, Marginal utility of money welfare function.

The formulation and implementation of equity and efficiency criteria in the selection of regional development projects in the United States is discussed. The authors construct and apply Bergsonian-type welfare functions in an operational context. A welfare index based on low family income, high unemployment rates and economic distress is constructed for use of the Economic Development Administration in project selection. This leads to a decision rule to evaluate all projects by weighting benefit-cost ratios by a welfare index. Following Eckstein, projects can be selected by maximizing the sum of the scores on the index subject to budget constraints. This method assists a program administrator by providing an operational project selection system flexible enough to allow for variation in project quality and for the tradeoff between efficiency and equity. This paper is relevant for water studies involved in the investment decision making process and project evaluation. (Siegenthaler-Rutgers)
W71-03655

INFORMED JUDGMENT, RIGOROUS THEORY AND PUBLIC POLICY,
Princeton Univ., N.J.
William J. Baumol.
Southern Economic Journal, Vol 32, No 2, p 137-145, October 1965.

Descriptors: *Welfare economics, *Decision-making, Probability, Economic growth, Costs, Marginal cost pricing.
Identifiers: Second-best theorem, Externalities, Optimality, Social welfare function, Subsidy, Pareto criteria, Net benefit.

The impact of the second-best theorem and externality theory on policy making is considered. The second-best theorem states that in a situation characterized by a deviation from perfect optimality, partial policy measures attempting to eliminate some of the deviation may result in a new decrease in social welfare. The impact of the theorem for public policy-making is considerable. For example, corrective policies attempting the application of marginal cost pricing might lead to reduction in social welfare. With respect to externalities, theory states activities resulting in external benefits will, without regulation, fall below the ideal level. Accordingly, public policy must expand these activities by subsidy but limit activities characterized by external costs. Recently, extensions of this theory indicate that a social welfare function with multiple maxima may exist as a result of externalities. This article indicates that it is still possible to achieve improvements in social welfare through the original externality theory. This article provides a general theoretical background to water research efforts involving issues of externalities and pricing policies. (Siegenthaler-Rutgers)
W71-03656

THE STATUS OF PPB IN FEDERAL AGENCIES: A COMPARATIVE PERSPECTIVE,
General Accounting Office, Washington, D.C.; and Bureau of the Budget, Washington, D.C.
Keith E. Marvin, and Andrew M. Rouse.
In: The Analysis and Evaluation of Public Expenditures: the PPB System, a compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee, U.S. Government Printing Office, Washington, D.C., Vol 3, p 801-814, 1969.

Descriptors: *Planning, *Budgeting, *Programing, *Economic evaluation, Forecasting, Systems analysis, Decisionmaking, Management, Government, Training.
Identifiers: *PPB, Federal agencies, Congressional attitude, Personnel qualification, Organizational pattern, PPB analysis.

This paper describes the current status of Planning, Programing and Budgeting, (PPB), in the Federal agencies and the facts which appear to account for the different degrees of effectiveness in its application. The article is based on recent surveys of PPB systems which looked at the way in which they had been developed from the point of view of agency management. The paper is of particular interest to the water researcher, not only for its description of the PPB process, but also for its isolation of those conditions which are most conducive to the development of an effective PPB system. The authors first describe what the original expectations for the PPB system were and what was actually created. Thirteen factors which appear in each agency that has made substantial progress toward the development of PPB systems for policy decisionmaking are isolated. (See also W70-08721) (Murphy-Rutgers)
W71-03657

RESCUING POLICY ANALYSIS FROM PPBS,
California Univ., Berkeley.
Aaron Wildavsky.
In: The Analysis and Evaluation of Public Expenditures: the PPB System, a Compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee, U.S. Government Printing Office, Washington, D.C., Vol III, p 835-864, 1969.

Descriptors: *Systems analysis, *Economic evaluation, *Budgeting, *Government, Planning, Decision-making, Training, Model studies, Risks, Programs, Federal budgets, Economic justification, Management, Demand, Supply.
Identifiers: *PPB system, Inertia defense analysis.

The author feels that, despite the increasing necessity for policy analysis in the governmental area, the Planning-Programming-Budgeting (PPB) system is completely inappropriate to current needs. Since this has often been used in evaluating public water resource investments, the author's ideas have relevance for the water resource planner. The paper discusses the flaws in the PPB system which have caused it to fall short of expectations. PPB was a success in defense analysis because extreme cases were allowed to determine the outcome. This cannot be done in non-defense projects and it is more difficult to apply in these areas. The author feels that the emphasis on program structure, and the formal connection of policy analysis with the budget cycle, sacrifice sound analysis, initiative and imagination for pro forma structure and schedule. (See also W70-08721) (Murphy-Rutgers)
W71-03658

THE ROLE OF COST UTILITY ANALYSIS IN PROGRAM BUDGETING,
Rand Corp., Santa Monica, Calif.
Gene H. Fisher.
In: Public Budgeting and Finance, Itasca, Illinois, Peacock Publishers, p 545-560, 1968.

Descriptors: *Cost-benefit analysis, *Decision-making, Planning, Economic evaluation, Risks, Management, Utility, Time, Budgeting, Resource allocation, Economic feasibility, Optimization, Systems analysis.
Identifiers: *Cost utility analysis, Rand Corporation, Program-budgeting.

This paper provides a discussion of considerations of the analytical process in program budgeting. The objective of this type of analytical effort is to systematically examine alternative courses of action in terms of utility and cost with the purpose of clarifying the relevant choices open to the decision maker. Thus, after a brief discussion of some analytical methods and techniques used in the program budgeting process, the author explains the use of cost utility analysis, pointing out six main characteristics and presenting an example of its use. The article demonstrates that where major uncertainties are present in decisions pertaining to the initiation of development for a total system, the analysis may suggest relatively inexpensive component development programs which minimize the risk. The analysis used in this study is closely related to cost benefit analysis and an understanding of this article could be of assistance in the evaluation of water resource investments. (Murphy-Rutgers)
W71-03659

CALIFORNIA'S PROGRAMING AND BUDGETING SYSTEM,
California State Dept. of Finance, Sacramento.
Edwin W. Beach.
In: Innovations In Planning, Programing, and Budgeting In State and Local Governments, a compendium of papers submitted to the Subcommittee On Economy In Government of the Joint Economic Committee, U.S. Government Printing Office, Washington, D.C., p 27-35, 1969.

Descriptors: *Planning, *Budgets, *Forecasting, *Management, Government, Financing, Costs, Benefits, Economic evaluation, Decisionmaking, Systems analysis, Data collection, *California.
Identifiers: *Programing, *PPB, Multi-year programs, Agency planning.

The necessity for choosing among many alternatives forced the development of the Programing and Budgeting System. The main value of the Programing and Budgeting System is that it provides an increased capability to consider the costs and benefits of various program alternatives. This is a problem consistently faced in the water resource area so that this article, which provides a review of the structure of California's Programing and Budgeting System and the progress to date in implementing it, should be of interest to the wate researcher. In addition, the author explains th relationship of the Programing and Budgetin System to the function of planning and states that is one of the most significant improvements to th management process in a long time. (Murphy-Rugers)
W71-03660

DEVELOPMENT OF P P B SYSTEM IN TH STATE OF MICHIGAN,
Michigan State Budget Director.
Paul A. Wileden.
In: Innovation In Planning Programing An Budgeting in State And Local Governments, compendium of papers submitted to the Subcom mittee On Economy In Government of the Joi Economic Committee, U. S. Government Printin Office, Washington, D.C., p 36-47 1969.

Descriptors: *Planning, *Budgeting, *Economi evaluation, Forecasting, Systems analysis, Trainin Benefits, Costs, Resource development, Financin Social aspects, Economic analysis, Government.
Identifiers: *Michigan, *Programing, *PPB, Mu tiyear framework, Program identification.

The author explains the need to replace the earlie types of input-orientated budget decisions wit those more relevant to purpose, performance an related cost factors. The article describes th planning, programing and budgeting (PPB) proce as being ideally suited for this purpose. The stru ture and components of the PPB system in the sta of Michigan, are described in relation to the obje tive of producing an out-put orientated progra budget within a multiyear framework, based o adequate systematic analysis of alternatives, an reflecting pertinent costs in relation to results. Th current stage of PPB development is discussed an the need stressed for greater personnel trainin The decisions that the state is forced to make a similar to those in the public water resources are The article appraises the PPB system as enabling more rational determination of the relevant prior ties in allocating scarce public resources, throug systematic analysis and evaluation of progra productivity in response to social needs. Thus, th use of this system may enable a better use of scarc public water resources. (Murphy-Rutgers)
W71-03661

P P B S IN CITY, STATE AND COUNTY: A OVERVIEW,
Selma J. Mushkin.
In: Innovations In Planning, Programing, an Budgeting In State and Local Governments, a com pendium of papers submitted to the Subcommitte on Economy In Government of the Joint Economi Committee, U.S. Government Printing Offic Washington, D.C., p 1-14 1969.

Descriptors: *Economic evaluation, *Planning Budgeting, *Decision-making, *Governmen Costs, Benefits, Forecasting, Optimization, Trai ing, Model studies, Economic efficiency, Resourc allocation.
Identifiers: *PPB, *Programing, 5-5-5 project.

In this paper the author describes the applicatio of planning, programing and budgeting (PP systems in the state and local governments as we as the results of the application of these system The PPB system has proven to be a method economic evaluation particularly suited to th water resource area. Thus, this article should pro of interest to those concerned with public wat resource investments. The author describes two a proaches to PPB systems application which sh labels as the incremental approach and the syst matic approach. They are evaluated in terms their effectiveness in forcing more rational publ decisions on the allocation of scarce resources an improved comparison of the cost and effectivene of program options. The results of a number of pr jects are analyzed, with emphasis on the problen involved and the lessons learned. The auth

esents those changes she thinks are necessary for more effective use of P P B systems. The paper ncludes with a list of the outputs of present appli-ations of PPB. (Murphy-Rutgers)
71-03662

HE NEW YORK STATE PLANNING, PRO-RAMMING AND BUDGETING SYSTEM,
avid A. Seyler.
: Innovations In Planning Programing and udgeting In State And Local Governments, a mpendium of papers submitted to the Subcom-ittee On Economy In Government of the Joint conomic Committee, U.S. Government Printing ffice, Washington, D.C., p 48-52 1969.

escriptors: *Planning, *Budgeting, *Economic aluation, *Decisionmaking, Costs, Benefits, recasting, Training, Optimization, Resource al-cation, Economic efficiency, Government, stems analysis.
entifiers: *New York, Programing, Program ucture.

nce 1964, New York State has been developing a anning, Programming and Budgeting System, PBS), which systematically relates the expendi-re of funds to the accomplishment of planned als. One of the initial steps was the development a Program Structure in order to provide a mework for resource allocation decisionmaking. ajor emphasis is also placed on the scheduling d execution of program analysis throughout state vernment. The PPB system has changed the dgetary process so that there has been a conver-n from a budget presented in object terms to a ogram budget. There are several problems maining in utilizing PPBS effectively with major mphasis needed on the development of meaning-l output information. The PPBS method of aluating alternatives is particularly useful in the ater resources area and New York State's ex-rience in its application should prove to be of in-rest to the water researcher. (Murphy-Rutgers)
71-03663

ER RESPONSE IN OUTDOOR RECREA-ON: A COMMENT,
rnell Univ., Ithaca, N. Y.
is E. Gosse, and Robert E. Kalter.
urnal of Leisure Research, Vol 2, No 2, p 131-4, Spring 1970.

escriptors: *Recreation, *Resource allocation, emand, Supply, Investment, Forecasting.
entifiers: *User response, Production function, pacity, Travel costs, Consumer surplus, Identifi-tion problem, Marginal rate of substitution.

e author considers the article: 'User Response in tdoor Recreation: A Production Analysis' (JLR: mmer 1969) by Senaca and Ciccheti. The oduction function for recreational sites in-oduced in the article is based on recreational use d not site capacity. Kalter and Gosse question e assumption that the total recreation consumed identical to the total output or capacity of the rk. With the recreation market implied, the pply of recreational facilities is so restricted that y given increase in supply would still result in a oportional increase in use or excess demand uld exist. However, the user response equation es not consider the possibility that the location of w facilities can influence the amount of new creational use. For policy making, a measure of e value of the potential recreational site to ciety is necessary in addition to the relation tween recreation use and supply yielded by the er response model. The value measure can be und by approximating the consumer surplus for e associated demand function. However, the user sponse model is an important aid for recreation anners. (Siegenthaler-Rutgers)
71-03664

AN ECONOMIC EVALUATION OF CONNECTICUT WATER LAW: WATER RIGHTS, PUBLIC WATER SUPPLY AND POLLUTION CONTROL,
Connecticut Univ., Storrs. Inst. of Water Resources.
Robert L. Leonard.
Available from NTIS as PB-196 898, $3.00 in paper copy, $0.95 in microfiche. Institute of Water Resources, Univ of Connecticut, Report No 11, July 1970. 67 p, 5 tab, 136 ref, 2 append. OWRR Project A-012-CONN (5).

Descriptors: *Connecticut, *Economic efficiency, *Water law, *Economic feasibility, Economics, Legal aspects, Water resources, Economic impact, Economic justification, Pollution abatement, Water quality control, Riparian rights, Cost-benefit analysis, Water supply, Streamflow, Regulated flow, Consumptive uses, Groundwater, Condemnation, Compensation, Administrative decisions, Recreation demand, Public rights, Grants, Legislation.

Utilizing economic criteria, this report analyzes Connecticut's water law system. The author employs as evaluatory tools cost-benefit analysis and the degree of economic flexibility afforded by water rights and regulations. Competing property rights, economic models, public policies and programs, and research incentives are interrelated with economic costs. Recommendations are made in four areas: (1) public water supplies, (2) water rights, (3) stream flow and groundwater management, and (4) pollution control. The effect of the non-riparian status of Connecticut's public water supplies is considered in light of condemnation powers, compensation requirements, and legislative restrictions. Locational advantages, common-law pollution protection, efficiency in allocating among consumptive uses, and the ineffectiveness of riparian doctrines in protecting recreational and environmental values are all discussed as they relate to suggested improvements in Connecticut's existing water law system. Stream flow and groundwater management are examined in terms of the authority needed for governmental management, stream flow objectives, administrative problems, and the impact on water users. The lack of economic incentives for pollution abatement, water-quality criteria, financial assistance, and the exercise of regulatory powers are considered in analyzing pollution and water quality control. (Earl-Florida)
W71-03732

A REGIONAL WATER RESOURCE MANAGEMENT PLAN FOR DANE COUNTY.
Bauer, Sheaffer, and McCall, Inc., Chicago, Ill.

Dane County, Michigan, Regional Planning Commission, 1970. 166 p, 23 fig, 13 tab, 2 append.

Descriptors: *Plan, *Regional analysis, *Water resources, *Sprinker irrigation, *Waste water treatment, *Waste management, Flow, Diversion, Groundwater basins, Water pollution, Eutrophication, Evaluation, Drainage.
Identifiers: *Goals, Agriculture drainage, Urban drainage, Madison metropolitan area, Stoughton area, Upper yahara river basin.

The report attempts to develop a conceptual plan for the total management of water resources, including both surface and groundwater. The key elements of the plan are two spray irrigation-waste water treatment facilities, one for the Madison Metropolitan Area and one for the Stoughton Area. The former would serve to discontinue the diversion of effluent and would return ti to the Upper Yahara Basin where more water flow, because of diversion, is needed. The plan includes a water supply element where repositioning of groundwater wells near groundwater basin perimeters would reduce potential groundwater contamination and increase the size of the groundwater basin. Also, a drainage element considers both urban drainage and rural-agricultural drainage and the possible management opportunities. (Miller-Chicago)
W71-03760

A PROGRESS REPORT ON THE FUTURE OF CHICAGO'S LAKEFRONT.
Johnson, Johnson and Roy, Inc., Ann Arbor, Mich.

Preliminary Report, February 1968. 52 p.

Descriptors: *Lake Michigan, *City planning, *Planning, *Resource development, *Parks, *Land use, Lake shores, Lakes, Aesthetics, Recreation, Recreation facilities, Management.
Identifiers: *Chicago, *Lakefront development.

A number of basic study objectives which characterize the report can be identified: (a) to reconfirm the manner in which the lakeshore has served the people of Chicago in the past; (b) to discover how the lakeshore is most effectively used today; (c) to discover the best possible use of the lakeshore as a recreation resource; (d) to chart the potentials for increased recreation land areas along the shore or off shore; (e) to match future potentials for use with appropriate access patterns; (f) to recommend basic action programs which would lead towards the full measure of future potential inherent in the lakeshore; and (g) to establish basic principles of shoreline development which can be directly beneficial to numerous and otherwise unrelated public and private developments along the shore. (Davis-Chicago)
W71-03761

ECONOMICS AND ECOLOGY,
Michigan Univ., Ann Arbor. Dept. of Economics.
Kenneth E. Boulding.
In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P. (The Natural Press: Garden City, New York, 1966) p 225-234. 1 ref.

Descriptors: *Economics, *Ecology, Equilibrium, Ethics.
Identifiers: Policy, Individuals, Species, Exchange systems, Closed systems, Resources.

While there has been little interaction between the sciences of economics and ecology, there are striking parallels between the two. Five basic similarities are outlined. First, both study not only individuals as such but individuals as members of species. Second, both have an important concept of general equilibrium, one dealing with population, the other with the price system. Third, both involve a system of exchange among their various individuals and species as an essential element in determining their final equilibrium, in one symbolized by the price system, in the other by the metabolic system. Fourth, both imply some concept of development. And fifth, important parallels fall under the general head of policy, i.e., the distortion of the system equilibrium in favor of man. The fact that we distort the ecosystem in favor of man does not mean that we destroy the principles of general equilibrium of populations. The author contends that the failure of most social policies is a result of man not cooperating with the ecological forces determining population equilibrium. In spite of the similarities there are important differences. Economists are irretrievably man-centered; no ecological concept corresponds to the economists' gross national product. The ecologists value system encompasses all species, and this difference involves deep ethical problems, among them species' extinction. However, man's speeding up of the evolutionary process puts up Dead End signs for the ecologist and Thin Ice signs for the economist. Finally, the author discusses the implications that result from looking at resources as infinite and looking at them in terms of a closed system. (Preckwinkle-Chicago)
W71-03762

STANDARDS AND TECHNIQUES OF EVALUATING ECONOMIC CHOICES IN ENVIRONMENTAL RESOURCE DEVELOPMENT,
Michigan Univ., Ann Arbor. School of Natural Resources.
Ayers Brinser.
In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P. (The Natural History Press: Garden City, New York, 1966), p 235-245. 27 ref.

Descriptors: *Economics, *Methodology, Investment, Conservation.
Identifiers: *Economic choice, *Environmental resource development, *Environmental quality, Comprehensive planning, Incremental planning, Criteria.

The author begins by defining terms. Economic choice is an attempt to state 'who should pay how much for what' and environmental resource development is equivalent to economic welfare with a major objective the enhancement of the quality of living. However, it is not clear that economics as defined by many practicing economists is a proper instrument for evaluating decisions about investment in environmental development. At present, it is argued, we are still in a period of trying to create methodologies. Concepts on which those methods are based are not resolving issues. The problem of evaluating economic choices remains in general terms to find measurements that will show how much more or how much less. It is unlikely that with present techniques such criteria could be embodied in a comprehensive plan. We lack the necessary tools for discovering either individual and social time preferences or for finding their proper relationship. The same problem of relationship holds for private and public finds invested in improving the quality of the environment. Comprehensive design with incremental planning may provide for more effective development. The criteria selected for alternative investment opportunities should be designed to promote growth and development. Rather than aiming at preserving what is or restoring the past, they should be concerned with improving the quality of choices that will come in the future. Again, incremental planning appears necessary. The major purpose of criteria must include increasing opportunities for external economics flowing from public as well as private investment with the choice of criteria not confined by an overwhelming concern for scarcity. (Preckwinkle-Chicago)
W71-03763

EVALUATION OF RECREATION AND AESTHETIC USES OF WATER IN AN URBAN SETTING,
Chicago Univ., Ill.
Orville F. Grimes.
Paper, Urban Economics Workshop, University of Chicago, 27 February 1970. 28 p, 6 fig, 2 tab, 16 ref.

Descriptors: *Evaluation, *Aesthetics, *Cities, *Recreation, *Economic impact, Planning, Urbanization, Water resources, Recreation demand, Recreation facilities, Benefits, Value, Shores.
Identifiers: *Urban areas, *Recreational uses, *Aesthetic uses, Value of views, Urban environment.

The structure of the demand for water-oriented outdoor recreation activities is examined. Also explored are the ways in which this demand is effected by concentrations of people in urban areas, characteristics of urban people, and the urban environment. Various categories of urban recreation benefits are specified: (a) public recreational use of shoreline inside or outside the city; (b) value of views of the water area to residents along the shoreline; (c) value of views of the water are to non-residents; and (d) private recreational use of shoreline inside or outside the city by city residents. Hypotheses regarding the relative importance of these benefits are examined. A category of benefits is selected for empirical analysis and some preliminary analysis, and some preliminary findings are presented. (Davis-Chicago)
W71-03765

WATER RESOURCES AND LAND USE OF THE PYRAMID LAKE INDIAN RESERVATION.
Wilsey and Ham, San Mateo, Calif.

Available from NTIS as PB-195 088, $3.00 in paper copy, $0.95 in microfiche. Final report to Economic Development Administration, EDACOMM-70-012, Oct 1970. 187 p, 13 tab, 15 fig, 44 ref.
Identifiers: *Water resources, *Nevada, *Economic development, Lakes, Employment, Land use, Stabilization, Irrigation, Electric power generation, Pyramid Lake, Pyramid Paiute Indian Reservation, Tourism, *Indian reservations, Technical assistance projects.

Data are presented and recommendations made for establishment of a permanent employment and income base for the Pyramid Paiute Indian Reservation in Nevada. Findings indicate public and private investment in the area have been inhibited because of uncertainty potable water supply, general land use planning, and the shrinking of the lake through diversion of the Truckee River. Restoration of river flows to stabilize the lake, and protection and enhancement of the lake to develop tourism are described as political and legal considerations. Economic value of water used to supplement flows in Pyramid Lake is discussed in terms of irrigation and operation of a power plant. Need for a general land use plan is described in terms of agriculture, town needs, conservation, and recreation and tourism.
W71-03769

SUMMARY OF EVALUATION PROCESSES IN WATER RESOURCES PLANNING,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Water Resources Bulletin, Vol 6, No 4, AWRA News, An AWRA Research Conference, Univ of Wisconsin - Milwaukee, June 14-19, 1970, p 700-703, July-Aug 1970. 4 p.

Descriptors: *Evaluation, *Planning, *Water resources, *Conferences, Optimization, Computers, Water quality control, Flood plains, Interest rate, Discount rate, Regional analysis.
Identifiers: Multiple objective functions.

A summary of the AWRA Conference, 'Evaluation Processes in Water Resources Planning', was given. Certain developments of general interest were summarized. First, the Conference reached a concensus that computer-based systems analysis is an essential part of the planning process which has not yet been fully utilized, and which has further capabilities particularly in the outlining of alternatives. However, opinions were expressed that, emphasis must be shifted to improve data and inputs, rather than approaches. It was thought that there is a need for expanded research in the nation-wide system of standards for water quality control established by the Federal Government. There was a discussion of benefits of environmental quality where it is extremely difficult to evaluate environmental objectives. Three alternative approaches to a system of planning based upon multiple objective functions were suggested at the Conference. It was explored in connection with the subject of metropolitan area planning. A session held on flood plain management excluded the matter of optimization of investment in flood control and flood plain zoning. Interest, discount rates, and regional benefits were discussed as well as political and institutional problems. The final session dealt with recommendations of a research program to improve the evaluation process. (Kriss-Cornell)
W71-03777

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House). Subcom
mittee on Conservation and Credit.
For primary bibliographic entry see Field 06E.
W71-03787

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FACTORS INFLUENCING RURAL WATE PURCHASE,
Kentucky Water Resources Inst., Lexington.
Charles R. Rosenstiel.
Available from NTIS as PB-196 658, $3.00 paper copy, $0.95 in microfiche. Technical repo Kentucky Water Resources Institute Research R port No 38, 1970. 45 p, 8 tab, 7 ref, 2 appen OWRR Project A-022-KY (9).

Descriptors: *Social change, Social values, Soci impact, Attitudes, Kentucky, Costs, *Water use *Water utilization, Water rates, *Water cos Prices.
Identifiers: Water purchase, Water needs.

An analysis is presented of factors which influen domestic water purchase among residents of a ru Kentucky county who must purchase hauled wat The results of the analysis are compared with pre ous studies of factors which influence domes water use by urban dwellers participating in a pip water distribution system. The results of the anal sis of rural water purchase corroborates t findings from the studies of urban water use, sho ing that the amount of water purchased by household is influenced by the socio-econom status of that household and by the price paid f water. As socio-economic status rises, domes water purchase increases, and as the price of wat increases the amount of water purchas decreases.
W71-03303

A GROWING MARKET FOR WATER AN WASTEWATER TREATMENT EQUIPMENT,
Business and Defense Services Administratio Washington, D.C. Water Resources and Engine ing Services Div.
For primary bibliographic entry see Field 05D.
W71-03597

ON THE INCIDENCE OF INCOME REDI TRIBUTION,
Iowa State Univ., Ames.
J. Ronnie Davis.
Public Choice, Vol 8, No 2, p 63-74, Spring 1970

Descriptors: *Welfare economics, Decision ma ing, Stability.
Identifiers: *Income redistribution, *Incidenc Game theory, Net payoff, Characteristic functi Marginal product.

The incidence of income redistribution is co sidered as a function of voting or fiscal decisi making rules. Three general fiscal institutions a investigated to determine the relationship betwe fiscal decision making institutions and redistrib tion. They are the democratic fiscal institutio which allow all members one vote each, taxpay fiscal institutions allowing only taxpayers a vo and proportional taxpayers fiscal institutions whe votes are in proportion to the amount of taxes pa Game theory is used to discuss the implications f income redistribution within the three institutio rules. The results indicate that only the democra rule can rely on individual voting to distribute come downward. The taxpayer and proportio rules redistribute in an inconsistent manner w the proportional rule generally redistributing come upward. The author concludes that in l than unanimous decision-making, some conce must be given to the incidence of income red tribution. There have been recent studies deali with the distributional effects of water investme

ects. This study provides a general framework nalyze the distributional aspects of government and investment policies. (Siegenthaler-Rutgers) 1-03600

TER RESOURCE ALLOCATION, EXTRA RKET VALUES, AND MARKET CRITERIA: UGGESTED APPROACH,
gon State Univ., Corvallis.
primary bibliographic entry see Field 06B.
-03603

URTHER NOTE ON THE COST IMPLICA-NS OF FLUCTUATING DEMAND,
ling Green State Univ., Ohio; and Rutgers - State Univ., New Brunswick, N.J.
y V. Smith, and Joseph J. Seneca.
nal of Financial and QUANITATIVE Analysis, 5, No 3, p 369-376, September 1970.

criptors: *Flexibility, *Demand function, ability, Cost function, Inventory, Constraint.
tifiers: *User costs, Production function, or series.

effect of fluctuating demand is discussed for a uct on factor input level and production cost e firm. Recent work by McKean has asserted in order to estimate the cost of production of a uct subject to fluctuations in demand, one consider the entire distribution of outputs with the static cost function. This paper nsiders this problem in the context of flexibili-'lexibility is present when the entrepreneur tains a range of factor inputs and minimizes cost of output over the relevant part of the uction function. In markets with variations in nd, the firm produces a probability distribu-of outputs and minimizes a total cost function iated with the production of that probability bution. The article shows that the static cost ion and the variable output cost function are dentical with the same input mix. Accordingly, se of the static cost function for firms with bility in demand will overstate the total cost of and superoptimum outputs and also distort ge cost. The concept of flexibility is relevant anning water supplies designed to meet wide tions in the demand for water use. enthaler-Rutgers)
-03608

T CHOICES AND RATE OF RETURN ULATION: AN OVERVIEW OF THE USSION,
eton Univ., N.J.; and Yale Univ., New Haven,
.
am J. Baumol, and Alvin K. Klevorick.
Bell Journal of Economics and Management ce Vol 1, No 2, p 162-190, Autumn, 1970.

riptors: *Economic efficiency, *Rate of n, *Government, Profit, Economic evaluation, al cost, Model studies, Management, Max-tion, Mathematical study, Cost minimization, nd.
ifiers: *Regulation, *Capital-labor ratio, ch-Johnson effect, Input proportions, Sales nization, Regulatory lag.

ch and Johnson demonstrated that rate of n regulation will modify the capital-labor ratio ed by the profit-maximizing firm. This paper ines the substance of the discussion that has n concerning the Averch-Johnson model. The should be relevant to those water utilities ct to governmental regulation. It restates the nt theorems and assertions and in addition des several basic proofs. It then examines related propositions that have been oped and discusses some work currently in ess in the area. In the last section the authors ude that there are dangers to economic effi-y in the rate of return approach to rate regula-ut that the phenomenon which arises from verch-Johnson theorem may not be of great icance in practice. (Murphy-Rutgers)

W71-03609

WATER ALLOCATION IN AN URBAN FRAMEWORK,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 06D.
W71-03613

PROBLEMS IN PUBLIC EXPENDITURE ANALYSIS,
Brookings Institution, Washington, D.C.
Samuel B. Chase.
Washington, D.C., the Brookings Institution, 1968. 269 p.

Descriptors: *Government, *Benefit-cost analysis, *Economic evaluation, Prices, Income, Time, Transportation, Social aspects, Economic efficiency, Government supports, Recreation, Taxes, Planning, Pollution.
Identifiers: Public expenditure analysis, *Income distribution, *Shadow prices, Travel time, Mortality, Cotton prices.

The book contains five papers and ten commentaries resulting from a conference on the problems of government expenditure analysis in September 1966. The first paper considers the difficulities of evaluating benefits and costs, particularly when private market prices cannot be used directly. The next two papers deal with the problems of valuing the savings of human time and human life. The value of time differs not only among persons and over each person's life span, but also among different uses and hours of the day. To determine the values put on reduced risk the author recommends the intensive interview technique to determine what the individual would be willing to pay for specified reductions in mortality probabilities. The next paper deals with the problem of income distribution effects and benefit cost analysis. It is shown that distributive effects must be considered along with traditional efficiency measures of expenditure programs and two methods for their inclusion are presented. The last paper discusses the distribution of benefits from cotton price supports. The discussions of these papers should aid in evaluating government water resources expenditures. In addition, the specific applicability of a number of papers to the evaluation of water supply and recreation benefits should provide specific interest to the water researcher. (See also W71-03615) (Murphy-Rutgers)
W71-03614

INCOME REDISTRIBUTION EFFECTS AND BENEFIT-COST ANALYSIS,
Wisconsin Univ., Madison.
Burton A. Weisbrod.
In: Problems in Public Expenditure Analysis, Washington, D.C., the Brookings Institution, 1968, p 177-209.

Descriptors: *Income, *Cost-benefit analysis, *Economic efficiency, *Decision-making, Government, Economic evaluation, Optimization, Welfare economics, Population, Recreation, Model studies, Water resource development.
Identifiers: *Income distribution, *Allocative efficiency, Distributional criteria, Weights.

This paper attempts to find a means by which economists can improve the quality of decisions on public expenditures through incorporation of the income distribution effects as well as the allocative-efficiency effects into the benefit-cost analysis of public projects. One device would be to determine how the total benefits and costs of each project would be divided among various population groupings. A second method would be to deduce the value judgements concerning the distribution of income which is implied by decision choices and then assign weights to the distributional effects. The author argues that consideration of the income distribution effects of public investments will improve the quality of advice provided by economic analysis. The paper discusses these in the context of several water resource projects, and the author shows that their specific inclusion in the economic evaluation could improve the decision-making process. (See also W71-03614) (Murphy-Rutgers)
W71-03615

THE SECOND-BEST CASE FOR MARGINAL COST PRICING,
Electricity Council, London (England).
R. Turvey.
In: Public Economics, London, Macmillan, 1969, p 336-343.

Descriptors: *Marginal cost pricing, *Resource allocation, Economic efficiency, Interest rate, Investment decision, Depreciation.
Identifiers: *Public enterprise, *Social cost, Social discount rate, Capital rationing, *Second-best case, Shadow pricing, Capital intensity, Book value.

Economic efficiency and the conditions for efficient resource allocation for public enterprises are discussed. The optimum conditions for economic efficiency occur when all prices are equal to the long run marginal cost of goods and services and when the interest rate used in decision-making is uniform throughout the economy and equal to the social discount rate. The problem of the second-best or sub-optimization for the public enterprise sector is analyzed. The marginal cost pricing rule is not applicable and therefore new rules are worked out to achieve sub-optimization. These rules are concerned with the following issues: the choice of inputs by a public enterprise of how to produce a set of outputs, and the determination of the relative prices of the outputs. For the first problem, the conclusion is that public enterprises should minimize costs calculated with market prices of inputs and corrected for divergence of social cost on the second issue, the prices of public enterprise products should equal long-term marginal cost within their sector and be proportional to sales outside the sector for a group of substitutes. This article is relevant for water studies concerned with the theoretical foundations of pricing problems in the public goods area. (See also W71-03616) (Siegenthaler-Rutgers)
W71-03618

POLITICAL AND BUDGETARY CONSTRAINTS: SOME CHARACTERISTICS AND IMPLICATIONS,
Ministry of Aviation, London (England).
P. D. Henderson.
In: Public Economics, London, Macmillan, 1969, p 310-325.

Descriptors: *Political constraint, *Budgetary constraint, Economic efficiency, Cost, Risk, Welfare economics, Systems analysis.
Identifiers: *Second-best rules, Decision rules, Economic growth, Shadow pricing.

Political and budgetary constraints are discussed in relation to other aspects of the public economy and to a wide range of policy issues. For economic efficiency and consistency, the choice of objective and the form of the constraints should be determined at high political levels to avoid piecemeal decisions. Flood control in the United States is cited as a violation of this principle. Constraints should be formalized and made explicit to aid in quantifying the implications of alternative policies in order to ensure their role in the decision-making process. The author suggests two methods of ensuring that political and budgeting constraints on expenditures programs are well designed. Within individual programs, the use of program budgeting and systems analysis is important. With respect to choice of programs, objective discussion without excessive political interference of expenditure allocation should occur. The article is important to water investment studies concerned with the political constraints to public decision making. (See also W71-03616) (Siegenthaler-Rutgers)
W71-03620

PURE THEORY OF PUBLIC EXPENDITURE AND TAXATION,
Massachusetts Inst. of Tech., Cambridge.
Paul A. Samuelson.
In: Public Economics, London, Macmillan, 1969, p 98-123.

Descriptors: *Public expenditure, Taxation, Resource allocation, Social welfare, Welfare economics.
Identifiers: *Public good, *Benefit theory, Ability-to-pay, Consumption externality, Game theory, Consumer surplus, Marginal utility of money, Pareto optimal, Algorithm.

The theory of optimal resource allocation of public and social goods is related to previous public finance writing. A public good is defined as one with the property of a consumption externality (that is, entering into two or more person's preference function simultaneously). Under this definition, there are pure private goods where the market mechanism operates and the whole field of public goods. A pseudo-demand analysis is presented for public and private goods with utility maximized subject to a state provided lump sum income. It is found that pseudo-laissez-faire does lead to Pareto optimality but not ethically maximum welfare. The tax theory relying on voluntarism is found to be false. It was impossible to separate benefit-allocation and redistribution-equity considerations. The author cites a need for analytical studies of public goods using algorithmic solutions immune to bilateral monopoly or game theoretic objections. The article is relevant to theoretical studies of the public good nature of water resource projects. (See also W71-03616) (Siegenthaler-Rutgers)
W71-03621

THE DISTRIBUTION OF THE BURDEN OF SEWER USER CHARGES UNDER VARIOUS CHARGE FORMULAS,
McMaster Univ., Hamilton (Ontario).
James A. Johnson.
The National Tax Journal, Vol XXIX, No 3, p 472-485, December 1969.

Descriptors: *Cost sharing, Economic efficiency, Resource allocation, Marginal costs, Revenue, Regressivity.
Identifiers: *User charge, *Sewer service charge, Burden, Equity, Externalities, Social cost, Social benefits.

This paper analyzes one type of user charge--the sewer service charge in terms of equity, resource allocation, revenue, and administrative objectives. The model divides users into residential, commercial and industrial categories. The burden for each category is then computed under ten sewer charge formulas by applying the charges to a model of a large eastern city. The measure of burden is the percentage of revenue that would be paid by categories of users under each of the sewer charges. The results indicate a large variance in the distribution of the revenue borne among the three categories of users. The residential share is highest when there is a flat or minimum fee with the commercial share being largest when the charge is based on property value. The industrial share is greatest if the charge basis is sewage strength but it is also high for a fixed rate. It is difficult to determine equity and resource allocation objectives which are satisfied in a formula. Hence, formula choice depends on the relative weights placed on the four objectives. The most efficient formulas by objective are: for equity, property assessment; for resource allocation, rate per unit of volume and strength; for revenue, all formulas, and for administration, flat fee and property assessment. (Siegenthaler-Rutgers)
W71-03629

POLLUTION, PROPERTY AND PRICES,
Toronto Univ., (Ontario).
J. H. Dales.
Toronto, University of Toronto Press, 1968. 111 p.

Descriptors: *Prices, *Waste disposal costs, Decision-making, Cost benefit analysis, Economic efficiency.
Identifiers: *Property rights, *Pollution costs, Net benefit, Social cost, User charge, Subsidy, Regulatory agencies.

The author considers pollution as a social problem involving collective decision-making. The costs of waste disposal are divided into pollution prevention costs and pollution costs. Cost-benefit analysis is illustrated as a method of decision-making about different pollution policies that are selected through political decision-making. The treatment of air and water as unrestricted common property is questioned with a more sophisticated approach suggested to property rights. The best strategy, the author suggests, for reducing waste disposal costs is a system of charging for user rights with the Government setting the level of permissible pollution. This book is relevant for water resource planners concerned with resource allocation. (Siegenthaler-Rutgers)
W71-03630

ZERO-BASE BUDGETING,
Texas Instruments, Inc., Dallas.
Peter A. Pyhrr.
Harvard Business Review, Vol 48, No 6, p 111-121, Nov-Dec 1970.

Descriptors: *Budgets, *Management, *Resource allocation, Economic evaluation, Costs, Alternatives, Benefits, Production, Planning, Decision-making.
Identifiers: *Support expense, *Zero base, Ranking, Voting, Cash flow.

Budgeting of future expenses other than those in the category of direct labor, materials and overhead expense is discussed. The budget process is described at Texas Instruments which, instead of adjusting the existing budget for the upcoming year, starts from a zero base viewing all its activities and priorities afresh and creates a new set of allocations for the upcoming budget year. The experiences of this company, as well as the budgeting principles involving cost-benefit analysis, are directly transferrable to the area of water resource budgeting. The procedure provides: (1) management with a definite means of control on support allocations of all kinds; (2) a method for describing all support expense minutely; (3) a means for classifying the alternatives to each; and (4) a method for sorting all alternatives by both importance and priority. (Murphy-Rutgers)
W71-03644

RATE OF RETURN ON INVESTMENT RISK,
Massachusetts Inst. of Tech., Cambridge.
Paul H. Cootner, and Daniel M. Holland.
Bell Journal of Economics and Management Science, Vol 1, No 2, p 211-226, Autumn 1970.

Descriptors: *Risk, Regression analysis, Marginal utility, Probability distribution.
Identifiers: *Rate of return, *Capital market, Book value, Risk averter, Capitalization, Skewness.

The study was undertaken to find an empirical basis for the Supreme Court ruling that a regulated utility should earn a rate of return equal to that of unregulated firms given corresponding risks. Business risk is defined as functionally related to earnings variability. The authors tested the hypothesis that there is a positive association between business risk and rate of return using regression analysis to explain the variation of industry rate of return with risk. The results are significant and indicate a positive relationship exists for both samples of companies and industries. The model explains about 30% of the variability in the rate of return among companies and industries. The results are considered in the light of recent research on financial risk. This article is of general relevance to rate of return issues involving water utilities. (Siegenthaler-Rutgers)
W71-03645

TECHNIQUES OF PROJECT APPRAISAL,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06B.
W71-03646

THE IMPACT OF INFLATION ON CAPIT BUDGETING DECISIONS,
Boston Univ., Mass.
Earl M. Foster.
Quarterly Journal of Economics and Statistics, 10, No 3, p 19-24, Autumn 1970.

Descriptors: *Inflation, Investment, Risk, Simu tion analysis, Depreciation.
Identifiers: *Capital budgeting, *Net present val *Monetary debtor-creditor hypothesis, Inter rate of return, New cash flow.

Most previous research on the effects of inflat on corporations has been concerned with wea distribution rather than with the financial decisi which must be made. This article develops a for la for evaluating investment proposals incorpo ing the effects of changes in the price level. allow for inflation, the net present value formul modified into a real value concept by discount for the time value of money and the percentage crease in its purchasing power. The formula further refined by distinguishing between co which are sensitive to changes in the price level those which are entirely independent (an indi consideration of the monetary debtor-cred hypothesis). This hypothesis states that du periods of inflation net monetary debtors gai the expense of net monetary creditors. The rela real profitability of different cost structures means of finance for capital investment along w risk implications are considered in the form This discussion is relevant for water investment dies concerned with capital budget (Siegenthaler-Rutgers)
W71-03647

INTEREST RATE POLICY FOR THE EVALU TION OF FEDERAL PROGRAMS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W71-03650

ON THE OPPORTUNITY COST OF BORRO ING,
Chicago Univ., Ill.
Arnold Harberger.
In: Economic Analysis of Public Investment D sions: Interest Rate Policy and Discounting An sis, Hearings of the Joint Economic Commit July 30, 31, and August 1, 1968, Washing Government Printing Office, p 57-65, 1968.

Descriptors: *Economic evaluation, *Interest r Discount rate, Taxes, Depreciation.
Identifiers: *Opportunity cost, *Public borrow Social cost, Capital market, Rate of return, U charge, Weighted average.

The report of the Comptroller General in evaluation of public investment is considered. report advocates that the cost of government b rowing should include not only the interest actu paid by the Government, but also an adjustm factor for the taxes which the government lose the income that would have occurred if an inv ment project was not undertaken. This adjustm factor accounts for the social costs resulting fr the borrowing. The author finds that the re stresses the cost to the Treasury of increme borrowing but neglects the costs to the econo Government borrowing may displace corporate vestment, noncorporate investment, reside construction, and purchases of consumer durab To find the opportunity cost of public borrowin weighted average of the rates of return applyin all relevant sectors of the private economy is u with the weights reflecting the degree of displa ment in each private sector. The cost of Gov ment borrowing is best measured by the rate o terest on Government bonds plus the tax loss on

ome foregone as a result of displaced private in-
tment. In the calculation of opportunity costs,
report omits property, sales, and excise taxes.
e author recalculates the social opportunity cost
recting for the omissions and derives higher
ults. This article is relevant for water studies
ncerned with the economic evaluation of water
estment project. (See also W71-03649)
egenthaler-Rutgers)
1-03651

ST/EFFECTIVENESS ANALYSIS: ITS SKS AND THEIR INTERRELATION,
neral Electric Co., Santa Barbara, Calif. TEM-

primary bibliographic entry see Field 06A.
1-03654

E ROLE OF COST UTILITY ANALYSIS IN OGRAM BUDGETING,
d Corp., Santa Monica, Calif.
primary bibliographic entry see Field 06B.
1-03659

ERATIONS AND MAINTENANCE COSTS OF RIGATION DISTRIBUTION SYSTEMS,
no Univ., Kimberly. Twin Falls Branch Experi-
nt Station.
E. Brockway, and A. E. Herbig.
ional Irrigation Symposium Paper, American
iety of Agricultural Engineers, p HH1-10, Nov
1970. 10 p 2 fig, 4 tab, 2 ref.

criptors: *Distribution systems, *Maintenance
ts, *Operating costs, *Estimating equations,
ter conveyance, *Irrigation systems, Irrigation
ricts, Irrigation canals, Pipelines, Irrigation
ration and maintenance, Project planning,
ifornia.
ntifiers: United States (Northwest).

eration and maintenance costs of twenty-five ir-
tion districts in the Northwest and California
e evaluated to determine differences in costs
ween open channel distribution systems and
e systems. Parameters affecting costs for the dif-
ent system types are outlined. Personnel require-
nts for administration, water control and main-
ance functions are presented. Large variations
arameters affecting costs prevents the selection
ny one district as typical of a specific type of
em. A multiple regression analysis utilizing
ameters which can be easily measured on exist-
systems and easily determined for proposed
ems was performed. The resulting predictive
ations indicate the feasibility of the approach
wever, increased sample size is desirable.
1-03779

0. Water Demand

E-IMPOUNDMENT RECREATIONAL USE TTERN AND WATERFOWL OCCURRENCE THE SAYLORVILLE RESERVOIR AREA,
a State Water Resources Research Inst., Ames.
primary bibliographic entry see Field 06B.
1-03373

ATER MANAGEMENT RESEARCH GROUP: RST REPORT (1969).
ganization for Economic Co-Operation and
velopment, Paris (France).
primary bibliographic entry see Field 06A.
1-03445

TERMINATION OF THE SIGNIFICANCE OF RIABLES AFFECTING RESIDENTIAL ATER CONSUMPTION,
erto Rico Univ., Mayaguez. Water Resources
search Inst.
pu Kuttan.

Available from NTIS as PB-196 873, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, Water Resources Research Institute, Mayaguey, Puerto Rico, September, 1970. 19 p, 1 tab, 20 ref. OWRR Project A-022-PR (1).

Descriptors: *Water demands, *Water consumption, *Consumptive use, Water utilization, *Municipal water, *Water supply, Statistical methods.
Identifiers: *Residential water consumption.

The purpose of this project was to identify the significance of variables affecting residential water consumption in the case of private urbanization dwellings in Puerto Rico. Separate sections deal with a survey of variables affecting residential water consumption and response variables for residential water consumption; design of a statistical experiment; experimentation and data gathering; analysis of data; and conclusions and recommendations. It is concluded that the number of bathrooms has the largest effect on per capita water consumption in the case of private urbanization homes in Puerto Rico. This study does not indicate that property value is a significant variable as believed by many. Conclusions are limited by the fact that no variable was found to be significant statistically. It is also seen that the error variance is very large. Recommended for investigation is an approach to account for two-factor interactions, i.e., interaction effect between variables such as, number of bedrooms and number of automobiles.
W71-03517

PAB PROCESS FOR ADVANCED WASTE TREATMENT,
Iowa State Univ., Ames. Engineering Research Institute.
For primary bibliographic entry see Field 05D.
W71-03519

LECTURES ON WATER MANAGEMENT.
Dept. of Environmental Engineering Science. Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 06B.
W71-03594

WATER AND CITIES AND INDUSTRIES,
Hazen and Sawyer, New York.
Richard Hazen.
Lectures on Water Management, Water Management Seminars, Johns Hopkins University, Baltimore, Maryland, October 26, 1964, p 25-34.

Descriptors: *Industrial use, *Municipal water, Water reuse, Water works, Water rates, *Water utilization.
Identifiers: Consolidated Edison Company of New York, Upland water, Port of New York Authority, Washington Suburban Sanitary Commission.

Municipal water consumption is compared to industrial use of water. The author described in general terms the quantity of water used by each, the rates each paid and the specific ways each used the water. Also discussed was the relative advantage of upland water supplies (i.e. unpolluted supplies) to reclaimed water. The author advocated identification and exclusion of harmful substances before entrance into the water supplies rather than filtration afterwards. Included also in this brief paper was a rationale for 'overbuilding water works'-a charge which the author (himself an engineer) explains is often directed against engineers who have constructed works larger than what is immediately needed. (See also W71-03594) (Holmes-Rutgers)
W71-03595

A FURTHER NOTE ON THE COST IMPLICATIONS OF FLUCTUATING DEMAND,
Bowling Green State Univ., Ohio; and Rutgers - The State Univ., New Brunswick, N.J.
For primary bibliographic entry see Field 06C.
W71-03608

WATER ALLOCATION IN AN URBAN FRAMEWORK,
West Virginia Univ., Morgantown.
Patrick Mann.
Nebraska Journal of Economics and Business, Vol 9, No 1, p 3-17, Winter 1970.

Descriptors: *Water supply, *Water demand, Decision making, Water resource management, Price elasticity, Watershed development, Salt water conversion.
Identifiers: *Water division, Sewage reclamation, Sewer charge.

The impact is considered of rapid urbanization in the United States on the future water supply. Large population growth has resulted in decision making aimed toward increasing regular water supplies via the alternatives of saltwater conversion, watershed development, and geographical diversion of water supply. The main issue in water supply is the necessity to compare all rational alternatives for meeting the increase in demand for water services. The relative costs of these alternatives must be considered as well as the costs of metering sewage reclamation and rate increases. The use of rate increases to ration water supply is a policy alternative which has been overlooked. The author contends that rational pricing may be more costly as an alternative than the expansion of water supplies through water diversion. Water supply and pricing must be analyzed in the larger framework of the problems of water quality and water-use management. (Siegenthaler-Rutgers)
W71-03613

POPULATION AND NATURAL RESOURCES,
Carnegie Institution of Washington, D.C.
Edward Ackerman.
In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, 1965, p 127-152.

Descriptors: *Population, *Natural resources, *Conservation, Technology, Economies of scale, Wastes, Irrigation, Evaporation, Water supply, Budgets, Sea water, Precipitation, Management, Water quality.
Identifiers: *Malthus, *Manufacturing, Productive life, Culture, Resource stability, Consumption.

This author studies the relationship between demography and resources through the use of an equation relating the demand and supply of natural resources. The article involves an extended discussion of the variables to be included in this equation. Correlation between population and the physical environment, geographical incidence of certain cultural factors, effects of institutional inheritance and the stability and quality of the resources are some of the topics treated. In addition certain 'feedback' items are discussed and all resource and culture attributes are studied as they correlate with demographic attributes other than number. Finally, all of the analysis is applied to a study of the world's population. In the concluding section on neo-Malthusian and anti-Malthusian views, two different prospects for resource adequacy are projected for the next decade, these being those for China-type countries and those for European-type countries. Co-ordinated population-resource-technology studies are suggested to deal with the problems of these two types of countries for the purpose of arriving at an understanding of what the limits of the earth may amount to in the immediate future. Many of the problems in the water resource area are common to all natural resources. Thus, this article should be of use to the water planner. (See also W71-03631) (Murphy-Rutgers)
W71-03638

USER RESPONSE IN OUTDOOR RECREATION: A COMMENT,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 06B.
W71-03664

6E. Water Law and Institutions

SIMPSON V MARTIN (TITLE DISPUTE TO RIPARIAN LAND DEPENDS ON WHETHER RIVER CHANGED COURSE BY ACCRETION OR AVULSION).

298 SW 861-863 (Ark 1927).

Descriptors: *Arkansas, *Boundaries (Property), *Avulsion, *Riparian land, Riparian waters, Riparian rights, Rivers, Navigable rivers, Bank erosion, Accretion (Legal aspects), Channel erosion, Prescriptive rights, Land tenure, Real property, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff riparian owner sued defendant riparian owner to quiet title to river front property. The record title showed that plaintiff's land was north of the river and defendant's land was south of the river. Plaintiff contended that the river had gradually moved south, the south bank being gradually washed away and the north bank moving south by accretions to plaintiff's land until the accretions to his land occupied what used to be defendant's land south of the river. Plaintiff also claimed adverse possession of the lands in question. Defendant contended that there was no accretion to the north bank or erosion of the south bank but that the course of the river had changed suddenly by avulsion and that the land next to plaintiff's was the same originally conveyed to defendants. Affirming a judgment for defendant, the court noted that property boundaries are presumed permanent, and one seeking to change those boundaries has the burden of proving that the change in the river's course was due to accretion rather than avulsion. The court reviewed the conflicting evidence and held that the lower court's finding that the land was not an accretion was not against the weight of the evidence. The court also noted that plaintiff did not exercise any adverse use of the entire property. (Liptak-Florida)
W71-03338

ARKANSAS POWER AND LIGHT CO V ORR (LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT FLOOD GATE OPERATION).
11 SW2d 761-762 (Ark 1928).

Descriptors: *Arkansas, *Dams, *Flood damage, *Floodgates, Rivers, Water injury, Hydroelectric plants, Legal aspects, Riparian waters, Reservoir operation, Judicial decisions, Adjudication procedure, Riparian land.

Plaintiff riparian owner brought action against defendant power company to recover for flood damage to plaintiff's lands and crops. The damage was caused by water released from defendant's dam. Plaintiff contended that defendant was negligent in operating it s floodgates, thereby flooding plaintiff's land and destroying his crop. Affirming a judgment for plaintiff, the court held that the conflicting evidence as to defendant's negligence was properly submitted to the jury. (Liptak-Florida)
W71-03352

LOUISVILLE AND N RR V VANDIVER (DIVERSION OF RIVER CAUSED BY OBSTRUCTION).
238 Ky 846, 38 SW2d 965-967 (1931).

Descriptors: *Kentucky, *Railroads, *Sand bars, *Alteration of flow, Flow around objects, Bridges, Piers, Susidence, Erosion, Flood damage, Water injury, Adjudication procedure, Legal aspects, Judicial decisions, Rivers, Streams, Riparian land, Bank erosion, Rocks, Floods, Diversion.

Plaintiff riparian landowner sued defendant railroad for damages from flooding and erosion caused by defendant's obstruction of a river. Defendant had erected a bridge over a creek at a point just before it flowed into the river upon which plaintiff's land bordered. To prevent the bridge piers from subsiding, defendant had placed large rocks in the creek. Unprecedented rainfall caused these rocks to wash onto a sandbar in front of plaintiff's land. The sandbar was previously seasonal, being washed away by heavy rainfall and gradually building up in the drier seasons, but the rocks now prevented it from washing away. The sandbar thus grew increasingly larger and began to divert the river, causing it to flood and erode plaintiff's land. Defendant contended that the injury was caused by the unprecedented rain, but the court noted that defendant's rocks were a 'but for' cause of the injury and refused to find error in the lower court's denial of a motion for a directed verdict. The lower court's judgment for plaintiff was affirmed. (Hart-Florida)
W71-03353

POINT PRAIRIE HUNTING AND FISHING CLUB V SCHMIDT (TITLE DISPUTE TO DRY RIVER BED BETWEEN ISLAND AND MAINLAND).
44 SW2d 73-76 (Mo 1931).

Descriptors: *Missouri, *Ownership of beds, *Boundaries (Property), *Accretion (Legal aspects), Rivers, Missouri River, Channels, Land tenure, Islands, Beds, River beds, Boundary disputes, Real property, Legal aspects, Judicial decisions, Adjudication procedure, Riparian land, Prescriptive rights, Surveys.

Plaintiff sued to quiet title to a dry river bed between plaintiff's island on the Missouri River and defendant's property on the mainland. The bed had been formerly a slough or arm of the River but had been gradually filled up so that portions of it were on a level with the island and mainland. Plaintiff claimed title to the island and to the land out to the center line of the old channel between the island and the mainland. Defendant contended that plaintiff's title only conveyed to the boundaries of the island and that the entire dry river bed vested in the mainland owner. Affirming a judgment for plaintiff, the court found that, since the county had already conveyed a portion of the bed to plaintiff, defendant's patent from the county could not have conveyed title to the entire river bed. Therefore, each party owned to the center line of the old channel. The court also noted that it was proper for the lower court to appoint a commission to determine the exact location of the center line of the old channel. (Liptak-Florida)
W71-03358

BAXTER V DAVIS (SALE OF RIPARIAN LAND).
252 Ky 525, 67 SW2d 678-682 (1934).

Descriptors: *Kentucky, *Riparian land, *Nonnavigable waters, *Boundaries (Property), Claims (Contracts), Flooding, Land use, Real property, Rivers, Acreage, Adjudication procedure, Judicial decisions, Legal aspects, Contracts, Land tenture.

Plaintiff vendor of riparian land sued defendant vendee to recover the amount owed on a contract for the sale of land. Defendant admitted the contract and the amount but contended that plaintiff had fraudulently represented the property as 7 1/2 acres, when it was only 5 acres, and as not subject to overflow. The court observed that the river on which the land bordered was non-navigable, and therefore the property boundaries extended to the thread of the stream, including more than 7 acres. Upon perusal of conflicting evidence, the chancellor had found that plaintiff either had not represented the land as not subject to overflow or that such a representation was substantially true. The court, stating that lower court's findings were not clearly erroneous, affirmed the lower court's decision for plaintiff. (Hart-Florida)
W71-03363

WABASH AND ERIE CANAL LANDS (DUTY OF STATE AUDITOR TO EXECUTE PATENTS TO ORIGINAL PURCHASERS OR GRANTEES).
Ind Ann Stat secs 62-901-62-914 (1962).

Descriptors: *Indiana, *Land tenure, *Real property, *Canals, State governments, Land, Legislation, Inland waterways, Administration, Governments, Legal aspects, Federal government, United States, Jurisdiction.
Identifiers: *Patents (Land).

The state auditor must execute patents to the original purchasers or their grantees for all Wabash and Erie Canal lands. Filing procedures are set forth. A patent deed of canal lands from the state auditor vests title in the grantee to the same extent as if a valid deed had been made to the original purchaser for consideration, but such deed does not affect the validity of prior interests or liens on the property. Disputes as to ownership of canal lands are within the jurisdiction of the circuit and superior courts in the county in which the lands are located. The purpose of this act is to correct errors in former conveyances, and no taxes paid may be recovered on the ground that title was formerly in the state. (Dye-Florida)
W71-03365

BECK V KULESZA (LANDOWNER'S RIGHT TO DIVERT STREAM).

156 A 346-50 (Sup Ct Del 1926).

Descriptors: *Delaware, *Obstruction to flow, *Artificial watercourses, *Alteration of flow, Riparian rights, Boundaries (Property), Riparian land, Riparian waters, Diversion, Streamflow, Streams, Reasonable use, Natural streams, Watercourses (Legal), Banks, Legal aspects, Judicial decisions, Tailrace, Flooding.

Plaintiff and defendant owned adjoining property separated by a stream. A tailrace on plaintiff's property ran parallel and below the stream. Defendant by placing debris in the stream's course diverted water which normally flowed in the stream into the tailrace. When the tailrace overflowed and flooded plaintiff's land, plaintiff sought damages against defendant. Defendant contended that plaintiff had originally constructed the stream course to divert water from the tailrace, the natural course, into the stream. Therefore, defendant argued that he was justified in obstructing streamflow and diverting the water back into the natural course. The Delaware Superior Court, in charging the jury, stated that plaintiff, in order to recover, had to provide that the stream was a natural watercourse. A riparian owner who diverts a natural stream from its accustomed channel is liable for damages from resulting overflow onto his neighbors' land. However, riparian owners can within reasonable time divert a stream from an artificial course through their lands back to a natural course. (Powell-Florida)
W71-03366

KINCAID V UNITED STATES (DUTY OF UNITED STATES TO CONDEMN LAND TO BE FLOODED BY DIVERSION CHANNEL).
35 F2d 235-248 (WD La 1929).

Descriptors: *Louisiana, *Levees, *Condemnation, *Federal government, Flooding, Damages, Governments, Flood control, Remedies, Legal aspects, Judicial decisions, Flood plains, Eminent domain, Compensation, State governments, Mississippi River, Political aspects, Legislation, United States, Adjudication procedure.

Plaintiff landowner sought to enjoin defendants Secretary of War, Chief of Engineers, and Mississippi River Commission from flooding his land. Plaintiff's land was situated betweeen two proposed levees and within a channel through which a portion of the waters of the Mississippi River were to be diverted. Plaintiff contended that defendants

uld not flood his land without first having fol-wed the proper condemnation procedures. De-ndants contended that because state law did not quire the state to pay for property taken for vees, the federal government was also protected the state statute. The court held that: (1) a state tute exempting the state from payment for pro-rty taken for levees does not exempt the federal vernment; (2) although the federal government s the authority to construct improvements on d in navigable waters and has police powers alogous to state police powers, a landowner has nding to sue to prevent the government from king his land for such improvements without con-mnation; and (3) riparian owners are protected m undue interference with their riparian rights alteration of streamflow. (Quesada-Florida)
71-03369

LVER SPRINGS PARADISE CO V RAY AND PATENT AS NOT DEPRIVING PUBLIC F RIGHT TO USE NAVIGABLE WATERS).
F2d 356-360 (5th Cir 1931).

escriptors: *Florida, *Public rights, *Navigable ters, *Ownership of beds, Streams, Public nefits, Federal government, Judicial decisions, gal aspects, Riparian rights, Riparian land, parian waters, Public lands, United States, Beds, ds under water, Relative rights, Land tenure, rings.
entifiers: Patents (Land).

aintiffs' predecessor in title had acquired a deral patent covering land contiguous to a vigable stream. Plaintiffs operated glass-bottom ats on a portion of the stream known as Silver rings. Defendant company acquired land near aintiffs' land and operated a rival glass-bottom-at business on the same portion of the stream. aintiffs sought to enjoin defendant's operations. aintiffs claimed that they had, by virtue of the tent which included land that was submerged by e navigable stream, exclusive rights to operate on e navigable stream. Defendant contended that, cause the United States held the title in trust to navigable stream-beds within the territory of orida, plaintiff did not not acquire any title to merged lands through his predecessor's patent. e Fifth Circuit Court of Appeals held that defen-nt's operation on navigable waters was an exer-e of the public right of navigation. Consequently, aintiff could not enjoin defendant's activities, twithstanding plaintiffs' ownership of the sub-rged lands. The land patent did not deprive the blic of the right to use the navigable waters vering land granted by the patent. Plaintiff quired title to submerged lands subordinate to e public right. (Powell-Florida)
71-03370

RKE V COMMONWEALTH (TITLE TO CCRETIONS WHERE DEED CONVEYS 'TO IE OCEAN').

3 Mass 63, 186 NE 277-280 (1933).

escriptors: *Massachusetts, *Accretion (Legal pects), *Breakwaters, *Boundary disputes, eans, Legal aspects, Judicial decisions, medies, Local governments, Coastal structures, ore protection, Boundaries (Property), Riparian nd, Land tenure, Shores, Beaches, Navigable ters, High water mark, Low water mark, ashores, Adjudication procedure.

aintiff sought to register title to an oceanfront lot d to land that accreted thereto as the result of the ection of breakwaters by defendant Common-ealth. Defendant town contended that the creted land belonged to it. Neighboring lan-wners contended that they were entitled to an nount of beachfront proportioned to the frontage their original lots. The Supreme Judicial Court Massachusetts affirmed a judgment for plaintiff. aintiff's deed conveyed title to the 'ocean'. onuments govern over measurements in describ-ing a lot's boundaries. Where accretions occur, the line of riparian ownership follows the changing water line. The court stated that the side lines should be at right angles to the low water mark. Defendant received none of the accretions. The other landowners, though now cut off from the new natural beach, were entitled only to the breakwater. Owners of upland without title to adjacent flats may be cut off from the beach by construction in aid of navigation. (Morris-Florida)
W71-03396

TRUSTEES OF NEWPORT CENTER V NILES (WATER COMPANY'S DUTY TO MAINTAIN WORKS AND ADEQUATE SUPPLY).
146 A 71-72 (Vt 1929).

Descriptors: *Vermont, *Administrative agencies, *Public utilities, *Water supply, Water quality, Domestic water, Springs, Watercourses (Legal), Water sources, Pipelines, Maintenance, Repairing, Legal aspects, Judicial decisions, Administration, Governments, Local governments, Water works, Water demand.

Plaintiff trustees of a village petitioned the Public Service Commission of Vermont to compel defendant water-company owners to repair unsatisfactory waterworks and to obtain an additional source of water supply. The Commission issued an order directing defendants to correct their deficiencies and to obtain the new source of water supply. Defendants appealed, and the Supreme Court of Vermont reversed and remanded. Evidence showed that the water system was out of repair. However, it was not shown that a new source of water supply was necessary to enable defendant to furnish customers with an adequate supply of wholesome water. The Commission exceeded its jurisdiction in ordering an additional source of water where the evidence did not show the need for one. (Duss-Florida)
W71-03480

MCGILL V THRASHER (OWNERSHIP OF ACCRETIONS IN RIVER BED BETWEEN ISLAND AND MAINLAND).
221 Ky 789, 299 SW 955-957 (1927).

Descriptors: *Kentucky, *Ownership of beds, *Accretion (Legal aspects), *Islands, Rivers, Streams, Navigable waters, Non-navigable waters, Ohio River, Banks, Bank erosion, Land tenure, Prescriptive rights, Boundaries (Property), Boundary disputes, Riparian rights, Riparian waters, Riparian land, State governments.

Plaintiff owned an island in the Ohio River. The island had greatly enlarged by accretion, extending it upstream and connecting it to the shore. Plaintiff sued defendant riparian owner to quiet title to the accretion opposite defendant's upland, and a second upland owner sued to eject plaintiff from the accretion connected to his property. The Court of Appeals of Kentucky noted that riparian owners own to the middle of the stream, including any land formations, and the same rights accrue to an island owner. However, the court hold that such ownership only includes those accretions adjacent to the riparian land and bounded by lines at right angles to the thread of the stream. Therefore, plaintiff could not claim the upstream accretions opposite defendant's shoreline. The court affirmed a judgment for defendant. The other riparian owner's suit rested on adverse possession. However, actual possession of the mainland was not adverse possession of the adjacent accretions. Therefore, the court reversed a judgment for the second mainland owner. (Liptak-Florida)
W71-03491

UNITED STATES V STEWART (LAND DESCRIBED AS BOUND BY THE WATER'S EDGE IS THAT LAND ABOVE THE MEAN HIGH WATER MARK).
121 F2d 705-714 (9th Cir 1941).

Descriptors: *California, *Islands, *Boundaries (Property), *Boundary disputes, Public lands, Patents, Grants, Judicial decisions, Legal aspects, Navigable waters, Reclamation, Swamps, Overflow, Tidal waters, High water mark, Low water mark, Tides, Tidal effects, Watercourses (Legal), Real property, Marshes.

Plaintiff United States sought to quiet title in itself to a certain island. Defendant contended that the only land that belonged to plaintiff was what was commonly known as Mare island and not the marsh lands attaching thereto. Plaintiff contended that it held title to all the land described in its grant as being bound by the water's edge. The court ruled that the water's edge was the same as the shore. The shore is the land between the ordinary high and low water marks. Where a sea or bay is named as a boundary, the line of the ordinary high water mark is always intended in jurisdictions where the common law prevails. The land in dispute was above the high water mark at the time of the grant and at the time of its confirmation. The trial court's judgment for defendant was affirmed in part and reversed in part. (Price-Florida)
W71-03524

GUCKER V TOWN OF HUNTINGTON (DESTRUCTION OF RIPARIAN RIGHTS OF ACCESS BY RAISING LEVEL OF SAND BAR).
268 NY 43, 196 NE 737-40 (1935).

Descriptors: *New York, *Sand bars, *Riparian rights, *Accretion (Legal aspects), Remedies, Land tenure, Real property, Navigable waters, Bays, Shallow water, Riparian land, Cities, Boundary disputes, Boundaries (Property), Ownership of beds, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff owned upland situated on a navigable river. Defendant town owned a sand bar in the waters adjacent to plaintiff's property. Defendant authorized other persons to raise the level of the sand bar to a height above the normal high tide level. The sand bar had previously been sufficiently submerged to allow passage of boats of light draft at high tide. Plaintiff claimed title in the sand bar by accretion and asserted that defendant's actions, by preventing access to the navigable bay, derogated his riparian rights. Affirming plaintiff's riparian right of direct access to the bay, the Court of Appeals of New York observed that the lower court had failed to provide plaintiff a remedy, although it had recognized that his rights were destroyed. Since the action was equitable, the lower court should have provided a remedy. This was so even though the trial court had found title to the sand bar to be in defendant. The lower court's decision was reversed. (Hart-Florida)
W71-03525

INVENTORY INFORMATION ON PUBLIC LANDS, VOLUME II.
Public Land Law Review Commission, Washington, D. C.

Available from NTIS as PB-194 198, $3.00 in paper copy, $0.95 in microfiche. Washington, D. C. July 1970. 127 p.

D
Identifiers: Public land, Technical reports, Inventories, Classifications, Financing, Records management, Organizations, Surveys, Information systems, Problem solving.

The statistical data on resources and uses which are available for section 10 lands are shown in Volume 1 of this study. Volume 2 examines agency objectives, standards and methods for the compilation of such data and summarizes staff findings of their adequacy for purposes of the Commission's studies.
W71-03528

VILLAGE OF MILL NECK V TOWN OF OYSTER BAY (ALLOCATION OF WATER DIS-

TRICT PROPERTY AMONG NEWLY INCORPORATED TOWNS).

140 Misc 164, 250 NYS 317-323 (Sup Ct 1931).

Descriptors: *New York, *Water districts, *Public utilities, *Cities, Local governments, Governments, Water supply, Real property, Land tenure, Public utility districts, Public lands, Public rights, Legal aspects, Judicial decisions, Assessments, Government finance, Legislation.

Plaintiff village brought action against defendant town to apportion and distribute the property of a water district. Plaintiff had been a part of the town and the water district and contended that upon incorporation it was entitled to a division of the water district's assets in proportion to the assessed value of plaintiff's property. The Supreme Court of New York noted that, although the statutes entitled plaintiff to an apportionment of the property, the legislature did not intend that the water district's property be sold and the proceeds divided among every new town or village. This would be impossible without destroying the water district. The court held that plaintiff was entitled to an apportioned interest in the water district's property. However, such interest should be neither divisible nor subject to partition and sale so long as the water district continued to function. (Liptak-Florida)
W71-03540

LEGAL RESTRAINTS ON AGRICULTURAL POLLUTION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 05G.
W71-03552

SIEGEL V STATE (STATE LIABILITY FOR NEGLIGENT IMPROVEMENT OF NAVIGATION).

138 Misc 474, 246 NYS 652-665 (Ct Cl NY 1930).

Descriptors: *New York, *Navigable waters, *Stream erosion, *Stream improvement, Damages, Eminent domain, Condemnation, Compensation, Legal aspects, Judicial decisions, Adjudication procedure, Canals, Streams, Non-navigable waters, Riparian rights, Riparian land, Erosion, Accelerated erosion, State governments, Bank erosion, Erosion control, Navigation.

Defendant state, for the purpose of improving a barge canal, lowered the bed of Fish Creek. Wood Creek, which flowed through plaintiff's property, emptied into Fish Creek. The lowering of Fish Creek caused Wood Creek to flow at greatly increased velocity, eroding plaintiff's land. Plaintiff sought damages for appropriation of his property. Defendant contended that it did not appropriate any of plaintiff's property or rights, but that plaintiff's losses were incidental to defendant's attempt to improve navigation. The Court of Claims of New York reversed a judgment for defendant. The acts of defendant, not being in an effort to improve the navigability of Wood Creek, but to improve the navigation in an entirely different channel, it could not escape responsibility for negligent injury to a riparian owner on Wood Creek. Negligence could be found in defendant's failure to erect structures capable of controlling the flow of Wood Creek. (Dye-Florida)
W71-03566

LECTURES ON WATER MANAGEMENT.
Dept. of Environmental Engineering Science. Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 06B.
W71-03594

CANADA - UNITED STATES INTERNATIONAL WATER PROBLEMS,
Manitoba Hydro, Winnipeg.
D. M. Stephens.
Lectures on Water Management, Water Management Seminars, Johns Hopkins University, April 5, 1965, p 264-281.

Descriptors: *International joint commission, Boundaries (Property), *United States.
Identifiers: *Boundary Waters Treaty, St. Lawrence Seaway, Columbia Storage Development, Passamaquoddy Tidal Project, *Canada.

The 400 miles of border between the United States and Canada includes countless numbers and varieties of bodies of water, ranging from meager streams to Lake Superior and the Columbia River Since the establishment of the Border Treaty of 1909, the International Joint Commission has resolved such issues as insuring equitable effects from one countries' diversion of rivers and overseeing a fair division of water resources and facilities which border both countries. The author deals at length with the instrumentation that the commission uses to carry out its work and praises its record of achievement. He stresses the need to adjust to the new problems of the future and mentions that the commission has already dealth with such joint concerns a pollution and maintenance of recreational facilities. (See also W71-03594) (Holmes-Rutgers)
W71-03596

INDIA EYES THE OCEAN'S RESOURCES,
Science Service, Washington, D.C.
S. K. Ghaswala.
Science News, Vol 98, No 1, July 4, 1970, p 22.

Descriptors: *Oceanography, Fish establishment, Fish farming, Trawling, Oil exploration, Government finance, Economics.
Identifiers: *India, *National Institute of Oceanography, Dr. N. K. Panikkar, Indian Ocean, Arabian Sea, Bay of Bengal, Fourth Five-Year Plan, Kerala, Marine Products Export Promotion Council, India Government's Oil and Natural Gas Commission, United Nations, The Deep Sea Fishing Station.

India's National Institute of Oceanography is aiding in the expansion of India's fishing industry by extensive exploration for new fishing waters and for deep sea water potentialities. The author points to the need for more and larger trawlers so that sufficiently mature fish can be caught in deeper waters further offshore. In addition to exploring for fish, the Indian government has begun to explore for oil in the Gulf of Cambay on India's west coast. It is expected that more than 4 million tons of crude oil will be obtained from offshore drilling by 1978-79. (Holmes-Trutgers)
W71-03599

POLITICAL AND BUDGETARY CONSTRAINTS: SOME CHARACTERISTICS AND IMPLICATIONS,
Ministry of Aviation, London (England).
For primary bibliographic entry see Field 06C.
W71-03620

WISCONSIN V MICHIGAN (NAVIGABLE WATER AS BOUNDARY BETWEEN STATES).

295 US 455, 55 S Ct 786-789 (1935).

Descriptors: *Wisconsin, *Michigan, *Boundary disputes, *Equitable apportionment, Boundaries (Property), Legal aspects, Water rights, Islands, Streams, Lakes, Great Lakes, Lake Michigan, Riparian rights, Bays, Federal jurisdiction, Judicial decisions, Channels, Bodies of water, Interstate.

The waters of Green Bay comprised a portion of the boundary between plaintiff Wisconsin and defendant Michigan. The enabling act creating the state of Michigan described the center of the 'most usual ship channel' of the Bay as the boundary line between plaintiff and defendant. A boundary dispute between the parties arose over the fact that two distinct ship channels existed, to either of which the description might apply. The United States Supreme Court, in affirming the opinion of special master, held that the waters of Green Ba should be divided between the states so as to giv equality of opportunity in use of its waters. I reaching its decision the Court considered the prin ciple that when a navigable stream is the boundar between states, the middle of the main channel, a distinguished from the geographical middle of th stream, limits jurisdiction of each state. This is s unless the boundary is otherwise fixed by agree ment. The Court assumed that Congress intende in the Michigan enabling act to give the partie equality of right and opportunity for navigation an fishing. (Powell-Florida)
W71-03626

ROSS V GRAFTON POWER CO (RIGHT TO DISCHARGE OF INDEBTEDNESS FOR FLOWAGE EASEMENTS).
1 F Supp 485-487 (D Vt 1932).

Descriptors: *Easements, *Debt, *Contracts *Payment, Riparian land, Legal aspects, Judicial decisions, Land use, Rivers, Electric power industry, Right-of-way, Land tenure, Leases, Investmen Cost repayment.

Plaintiff holder of riparian flowage easement sought equitable discharge of indebtedness ce tificates issued to riparian owners for such ease ments. Under contract, plaintiff had transferred th flowage rights to defendant power company's a signor. The easements were granted in return for promise by defendant to indemnify plaintiff agains all claims by holders of indebtedness certificate Plaintiff did not allege any breach of contractua duty by defendant, but contended that he was ent tled to discharge of the indebtedness certificates b defendant, despite the promise of indemnificatio by defendant. The court held plaintiff's action pre mature. A riparian easement holder who unde terms of contract is offered adequate indemnity i not entitled to discharge of indebtedness for suc easements. Plaintiff's action for accounting an discharge was dismissed for failure to state a caus of action. (Earl-Florida)
W71-03628

PROBLEMS IN ACHIEVING SOIL AND WATER CONSERVATION.
National Academy of Sciences, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-03634

WORLD RESOURCES AND TECHNOLOGY,
London Univ. (England).
L. Dudley Stamp.
In: Readings in Resource Management and Conser vation, Chicago, University of Chicago Press, 1965 p 97-103.

Descriptors: *Natural resources, *Technology *Conservation, Alluvial channels, Population Economic aspects, Recreation, Water resources Moisture, Fish, Statistics, Rivers, Erosion, Farming Fertilizers, Irrigation, Drainage, Economic efficien cy, Cultivation.
Identifiers: *Zuyder Zee, *Polar lands, *World resources, Oceanic trench, Chemicalization.

This article discusses the problems faced by th world community in maintaining its economic well being through the prudent use of the world resources. Technology is cited as a means that ha been, and will continue to be, quite helpful in thi endeavor. The role of water resources is especiall important to economic maintenance and develop ment. One example cited is the Dutch reclamatio of the Zuyder Zee and the alluvial banks at th mouth of the Rhine. The U.S. depression of th 1930's coupled with successive bad season focused American attention on the problems of soi erosion, and the need for action similar, although not quite as drastic, as the Dutch. It is suggested that it may be economically feasible to retrieve

uable material carried into American rivers rough the erosion process. (See also W71-631) (Murphy-Rutgers)
71-03640

DASTAL PETROLEUM CO V SECRETARY THE ARMY (NON-NAVIGATIONAL OUNDS FOR DENIAL OF PERMIT TO MINE NAVIGABLE LAKE BED).

5 F Supp 845-850 (SD Fla 1970).

scriptors: *Rivers and Harbors Act, *Lake beds, ining, *Permits, Leases, Florida, Lakes, Navigawaters, Navigation, Mineral industry, Excava-n, Administrative agencies, State governments, nedies, Damages, Compensation, Legal aspects, icial decisions, Water quality, Water supply, ter conservation, Water resources, Saline water rusion, Ecology, Regulation.
ntifiers: *Lake Okeechobee.

intiff mining company sued to compel defen-t secretary of the army to issue a permit to mine estone in Lake Okeechobee, a navigable lake. intiff contended that it had a legal right to mine ler leases from the state and that defendant ld not deny a permit since there had been no ling that the mining would interfere with naviga-n. Defendant contended that it could deny the mit in view of the mining's detrimental effect on dlife and the danger of saline intrusion into the e, a major fresh water supply for the state. De-dant also argued that limestone was not within terms of the mineral leases from the state. The rt held that defendant could not deny a permit other than navigational reasons and that the dity of the mining leases as to limestone had al-dy been established by state court decisions. wever, the court refused to order the issuance of permit because of the potential harm to the lic interest. Plaintiff's remedy was damages for oss of profits. (Liptak-Florida)
1-03684

NNECO, INC V GREATER LAFOURCHE RT COMM'N (LIABILITY FOR COST OF ELINE CHANGES BECAUSE OF CHANNEL PROVEMENT).

F2d 1061-1066 (5th Cir 1970).

criptors: *Pipelines, *Permits, *Channel im-vement, *Right-of-way, Navigable waters, Bay-Louisiana, State governments, United States, ulation, Public rights, Easements, Eminent ain, Condemnation, Legal aspects, Judicial isions, Oil, Oil industry, Navigation.

ntiff oil company brought action against defen-t port commission to recover the cost of lower-a pipeline crossing a navigable channel. Defen-t contended that both plaintiff's state and ral permits required it to bear the cost of nges necessitated by channel improvement. ntiff contended that the permit requirements lied only to that part of the pipeline covered by permit, that is, that part of the pipeline under gable waters. Plaintiff argued that defendant liable for the cost of changes in the pipeline on cent upland. Reversing a judgment for defen-t, the court held that conditions in the permits ld only be construed as applicable within the al pipeline right-of-way, not to portions of the eline outside of the right-of-way and on private perty. (Liptak-Florida)
1-03705

ECONOMIC EVALUATION OF CONNEC-UT WATER LAW: WATER RIGHTS, BLIC WATER SUPPLY AND POLLUTION NTROL,
necticut Univ., Storrs. Inst. of Water ources.
primary bibliographic entry see Field 06B.
1-03732

KING V UNITED STATES (INVERSE CONDEMNATION BY FLOODING FROM BACKWATER).

427 F2d 767-770 (Ct C1 1970).

Descriptors: *Dams, *Backwater, *Condemnation, *Floods, Water injury, Flood damage, United States, Kansas, Federal government, Rivers, Navigable rivers, Damages, Compensation, Riparian land, Riparian waters, Riparian rights, Overflow, Legal aspects, Judicial decisions, Eminent domain, Condemnation value.

Plaintiff landowners brought action against defendant United States for inverse condemnation of their property, which was intermittently flooded by backwater from a dam. Plaintiffs contended that the flooding resulted in a taking of their property. Defendant contended that plaintiffs' property was subject to flooding before the erection of the dam and that some plaintiffs claimed damage to lands rented out to other plaintiffs as crop tenants. The court held that the construction of the downstream dam, subjecting property to increased flooding, constituted a taking of property under the fifth amendment. The court also noted that it was possible to separately compensate those owning different interests in the land and crops. Judgment was entered for plaintiffs. (Liptak-Florida)
W71-03745

BRYANT V PEPPE (TITLE TO SUBMERGED LAND REMAINS IN STATE AFTER EMERGENCE BY AVULSION).
238 So 2d 836-839 (Fla 1970).

Descriptors: *Florida, *Ownership of beds, *Avulsion, *Land tenure, Boundaries (Property), Beds, Navigable waters, State governments, Gulf of Mexico, Taxes, Assessments, Boundary disputes, Riparian land, Riparian waters, Real property, Islands, Legal aspects, Judicial decisions, Public lands, Public rights.

Plaintiff landowners sued defendant state public land trustees to quiet title to land. The land had been submerged between two keys, but emerged as dry land as a result of avulsion during a hurricane. The state claimed the land as sovereignty land by reason of its originally submerged character. Plaintiffs contended that they held title by virtue of equitable estoppel because the land had been assessed as gulf-front property and plaintiffs had paid taxes thereon for many years. Reversing a judgment for plaintiffs, the court held that equitable estoppel was a proper remedy to bolster title already existing. However, estoppel could not be used to divest the state of its title. Submerged land does not lose its sovereign character when, by avulsion, it becomes dry land. (Liptak-Florida)
W71-03746

LANGEVIN V FLETCHER (BOUNDARY DISPUTE WHERE CONVEYANCE IS TO BANK OF BROOK IN RAVINE).
273 Mass 543, 174 NE 194-196 (1931).

Descriptors: *Massachusetts, *Boundry disputes, *Streams, *Banks, Beds, Boundaries (Property), Real property, Land tenure, Adjudication procedure, Legal aspects, Judicial decisions, Ravines, Gullies, High water mark, Ownership of beds, Land, Channels.

Plaintiff riparian landowner sought to register her land. Defendant contiguous landowner opposed her registration. Both tracts had formerly been owned by plaintiff, but plaintiff had conveyed defendant's tract to her brother. The conveyance was to the 'bank' of a brook which was in the bottom of a deep ravine with long sloping sides. Defendant contended that his boundary was the edge of the stream at the ravine's bottom, whereas plaintiff asserted that the boundary was the top of the ravine. Noting that a conveyance bounded by a stream bank normally excludes the streambed when the bank has a width apart from the bed, the Supreme Judicial Court of Massachusetts observed that an unusual meaning attributed to 'bank' might be shown from the entire deed and the surrounding circumstances. The court held that the deed was ambiguous, permitting introduction of extrinsic evidence to show plaintiff's intent. On the introduction of such evidence, the court held that the conveyance was to the top of the ravine, although it had never been a 'bank' of the stream. (Hart-Florida)
W71-03756

A UNIFIED NATIONAL PROGRAM FOR MANAGING FLOOD LOSSES.
Task Force on Federal Flood Control Policy, Washington, D.C.

Report by the Task Force on Federal Flood Control Policy, House Document No 465, transmitted in a communication from the President of the United States, Aug 1966. 47 p, 11 fig.

Descriptors: *Flood control, *Flood plains, *Flood forecasting, *Federal government, Flood damage, Flood plain insurance, Rivers, Floods, Planning, Costs, Cost sharing, Engineering structures, Levees, Reservoirs, Watersheds (Basins), Channels, Water policy, Projects, Project planning, State governments, Feasibility studies, Federal project policy, Administrative agencies, Flood plain zoning, Legislation.

Submitting its report on methods of reducing flood losses, the President's Task Force on Flood Control Policy stresses the need for a more unified national program. Basic proposals by the task force indicate a need: (1) to improve basic knowledge about flood hazards, (2) to coordinate and plan new developments on the flood plains, (3) to provide technical services to managers of flood plain property, (4) to move toward a practical national program for flood insurance, and (5) to adjust federal flood control policy to sound criteria and changing needs. Under these basic headings are delineated the roles of various federal agencies in collection and dissemination of flood information, flood forecasting, and assistance to states in flood plain planning. Cost-sharing requirements, flood project benefits and other monetary aspects of flood control programs also receive attention. The report describes the present condition of the nation's flood plains in terms of past federal investment in: (1) flood control, (2) past flood losses and estimated future losses, (3) effectiveness of flood control projects, and (4) benefits derived from them. Elements bearing on the problem of flood damages are also discussed. (Duss-Florida)
W71-03773

EXECUTIVE ORDER 11296 (EVALUATION OF FLOOD HAZARD IN FEDERAL ACTIVITIES).
Exec Order No 11296, Federal Register, Vol 31, No 155, Aug 11, 1966. 2 p.

Descriptors: *Federal government, *Floods, *Flood plains, *Administrative agencies, Flood damage, Flood control, Flood protection, Structures, Construction, Government finance, Regulation, Highways, Land, Administration, Federal budgets, Planning, Administrative decisions, United States.
Identifiers: *Executive orders.

Because of the existant uneconomic use of the nation's flood plains, the increasing potential for flood losses, the extensive federal involvement in construction of facilities in flood hazard areas, and the determining factor federal financing can play in land development, the President issued to various federal agencies Executive Order 11296. The President ordered that heads of executive agencies encourage a unified effort to prevent uneconomic uses of flood plains and, particularly, act to lessen the risk of flood losses in connection with federal lands and institutions. All agencies involved with construction of federal structures, government financing of structures, disposal of federal land,

and land use planning were ordered to evaluate flood hazards in their respective spheres of operation. The heads of each agency may issue appropriate rules and regulations to accomplish the first objective of the order. Agencies to which requests for flood hazard information may be addressed are specified. In all requests for appropriations for federal structures, the agency involved shall transmit to the Bureau of the Budget its findings regarding evaluation of flood hazards in the proposed development. (Duss-Florida)
W71-03778

BOUNDARY WATERS PROBLEMS OF CANADA AND THE UNITED STATES (RESOLUTION OF BOUNDARY DISPUTES BY THE INTERNATIONAL JOINT COMMISSION),
L. M. Bloomfield, and Gerald F. Fitzgerald.
Boundary Waters Problems of Canada and the United States, Carswell Co, Ltd, Toronto, Canada (1958). 264 p, 1 map, 329 ref, 9 append.

Descriptors: *United States, *Treaties, *International waters, *International Joint Commission, International law, Water law, Federal government, Foreign waters, International commissions, Legal aspects, Judicial decisions, Governments, Administrative agencies.
Identifiers: *Boundary waters.

In the Boundary Waters Treaty of 1909 between the United States and Canada, the International Joint Commission was formed and charged with judicial, investigative, administrative, and arbitral functions pertaining to boundary waters. This work relates: (1) the history of the Commission's formation, (2) purposes of the treaty, (3) the Commission's activities, and (4) the Commission's organization and rules of procedure. A detailed examination of the Commission's judicial function includes: (1) jurisdiction, (2) treaty rules governing judicial decision, (3) orders of approval, (4) compensation and indemnity, and (5) agreements between parties. The author concludes that: (1) the Commission has functioned extremely well, (2) the main prospective role will be investigation and recommendation, (3) the Commission has been reluctant to decide legal issues, and (4) regional and local requirements have been given careful consideration. Included in the work are summaries of the first 72 cases brought before the Commission. (Hart-Florida)
W71-03781

MAINE LAW AFFECTING MARINE RESOURCES, VOLUME I: STATE GOVERNMENT ORGANIZATION: AGENCIES DEALING WITH MARINE RESOURCES.
Maine Univ., Portland. School of Law.

Available from NTIS as PB-189 467, $3.00 in paper copy, $0.95 in microfiche. University of Maine Law School, 1969. 156 p, 1 chart, 351 ref.

Descriptors: *Maine, *State governments, *Administrative agencies, *Administration, Governments, Legislation, Political aspects, Legal aspects, Institutions, Organizations, Regulation, Coordination, Administrative decisions, Water law, Economics, Leadership, Planning , Water resources development, Water resources, Resources, Natural resources, Water policy, Conservation, Water conservation.
Identifiers: *Marine resources.

An important aspect of Maine law affecting marine resources is the structure of the administrative machinery responsible for ocean related activity. This survey of Maine agencies seeks to answer several questions: (1) Could better management of Maine's ocean potential be achieved by realignment or consolidation of existing entities. (2) What should be the configuration of the new administrative structure. (3) What are reasons for the charges and obstacles to be overcome. The discussion is divided into four parts. Part I summarizes the general administrative structure of water resources agencies and gives general suggestions for consolidation and improvement. Part II describes those agencies which, although not exclusively marine agencies, affect marine resources, including each agency's interrelationship with other agencies in the field. Part III suggests consolidation of some functions and describes political factors and attitudes which have impeded reorganization in the past. Part IV presents those proposals of previous reports, governors, and other state officials which have received inadequate notice and implementation. (See also W71-03784 thru W71-03786) (Dye-Florida)
W71-03783

MAINE LAW AFFECTING MARINE RESOURCES, VOLUME II: STATE, PUBLIC, AND PRIVATE RIGHTS, PRIVILEGES, AND POWERS.
Maine Univ., Portland. School of Law.

Available from NTIS as PB-189 468, $3.00 in paper copy, $0.95 in microfiche. University of Maine School of Law, p 157-417, 1970. 6 charts, 746 ref, 1 append.

Descriptors: *Maine, *Public rights, *Riparian rights, *Water law, Legal aspects, Relative rights, Natural resources, Coasts, Harbors, Oceans, Administrative agencies, Planning, Legislation, Water resources development, Marine fisheries, Fishing, State governments, Federal government, Water resources, Conservation, Boundaries (Property), Accretion (Legal aspects), Avulsion, Judicial decisions.
Identifiers: *Marine resources, Private rights.

Volume II of a four-volume report on Maine law affecting marine resources, this work examines Maine water resources law and its social and economic impact on the exploitation of the state's marine-related resources. Chapter I appeared in Volume I and dealt with state government structure. Chapter two discusses international, federal, and state law regarding marine boundaries, including: (1) the extent of state territorial waters; (2) local governmental boundaries; (3) private and public lands at the seashore; (4) construction of deeds of conveyance between adjacent riparian owners; and (5) the effects of accretion, avulsion, and reliction on boundaries. Chapter three deals with relative public and private rights in tidal lands and water, with emphasis on the colonial ordinances from which such law is derived. Classification of waters as navigable or non-navigable is examined, along with the state's right to regulate navigation. Chapter four discusses the legal structure within which the state may exploit or dispose of Maine's water resources. Constitutional limitations on the state are explored, concluding with the opinion that few such strictures exist. An appendix lists cases referred to in Volumes I and II. (See also W71-03783) (Dye-Florida)
W71-03784

MAINE LAW AFFECTING MARINE RESOURCES, VOLUME III: REGULATION OF THE COAST: LAND AND WATER USES.
Maine Univ., Portland. School of Law.

Available from NTIS as PB-192 023, $3.00 in paper copy, $0.95 in microfiche. University of Maine Law School, p 419-627, 1970. 1 map, 2 illus, 2 chart, 497 ref, 4 append.

Descriptors: *Maine, *Land use, *Regulation, *Coasts, Land management, Shores, Land resources, Natural resources, Legal aspects, Legislation, Land development, Recreation, Zoning, State governments, Local governments, Institutions, Planning, Water resources development, Water resources, Water pollution, Water law, Water pollution control.
Identifiers: *Marine resources.

Volume III of a four-volume report on Maine law affecting marine resources, this volume deals with coastal regulation relating to land and water uses. In Chapter five the extent and effects of polluti in Maine's coastal waters are discussed, along w the common law and statutes bearing on water p lution in Maine. Chapter six considers Maine l regulating coastal land and the adjacent envir ment. Laws are discussed as to their necessity a appropriatenesss, with emphasis on regulation recreational usage. Municipal, regional, and st planning to maintain and improve the quality coastal land usage is also emphasized. Chap seven attempts to apply concepts of land use c trol to water areas below the low-water mark, as which a comprehensive plan for usage regulatio otherwise lacking. Chapter eight examines the fect of state taxation on marine resource usa Chapter nine discusses state and federal machin dealing with problems of coastal erosion. Chap ten reviews water-related legislation enacted b 1970 special session of the Maine legislatu reproducing in full acts: (1) preventing the dun ing of out of state waste in Maine waters; (2) re lating selection of industrial sites; and (3) preve ing petroleum pollution of coastal waters. (See a W71-03783) (Dye-Florida)
W71-03785

MAINE LAW AFFECTING MARI RESOURCES, VOLUME IV: RESOURC FROM THE SEA AND FEDERAL LIMIT TIONS ON STATE CONTROL.
Maine Univ., Portland. School of Law.

Available from NTIS as PB-194 131, $3.00 paper copy, $0.95 in microfiche. University Main Law School, p 629-903, 1970. 2 tab, chart, 582 ref, 2 append.

Descriptors: *Maine, *Water resources devel ment, *Federal jurisdiction, *State jurisdicti Natural resources, Resources, Legal aspe Legislation, Governments, State governmen Federal government, Regulation, Administrati Water resources, Resource development, Fishi Commercial fishing, Fisheries, Fish harvest, F management, Ecology, Fish conservation, Mini Exploitation, Mineral industry.
Identifiers: *Marine resources.

Volume IV of a four volume report on Maine affecting marine resources, this volume is c cerned with international, federal, and state reg tion of the extraction of resources from the s Chapter eleven deals with treaties and laws affe ing Maine fisheries. The ends sought by fishing l are discussed, with an attempted evaluation of th effectiveness. Included are taxing provisio prohibitions against foreign fishermen, anti-t regulations, and the economic and ecological c siderations influencing fishing regulation. Chap twelve deals with legislation regulating the extr tion and cultivation of renewable marine resour mainly shellfish. The conflict between commer fishing for such resources and their conservat for public use is emphasized. Chapter thirt discusses restrictions on the utilization of mar resources as food, emphasizing health and qual control measures. Consideration is given to reg tion under the Federal Food and Drug Act and efforts to promote and market Maine's mar products. Chapter fourteen discusses regulati and state agencies governing extraction of mine from Maine's waters. Chapter fifteen deals w federal imitations on state control of mar resources--both under the constitution and un federal legislation. (See also W71-03783) (D Florida)
W71-03786

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House). Subco mittee on Conservation and Credit.

Hearings, 91st Cong, 1st Sess, July 8, 9, Aug 4, S 23, 25, Oct 15, 20, 1969. 213 p.

Descriptors: *Watersheds (Basins), *Wa resources development, *Flood protecti

gislation, Watershed management, River basin elopment, Multiple,purpose projects, Project efits, Project purposes, Project feasibility, Pro- planning, Programs, United States, Govern- ts, Flood control, Social aspects, Water policy, al aspects.

rings before the Subcommittee on Conserva- and Credit of the Committee on Agriculture e held to hear testimony concerning various rshed protection and flood prevention pro- . The watershed projects involved were ted in Arizona, Arkansas, California, Florida, rgia, Iowa, Indiana, Kansas, Kentucky, Loui- a, Mississippi, Missouri, Minnesota, Nebraska, ada, New Mexico, North Carolina, Ohio, Ten- ee, Utah, Virginia, West Virginia, and Wyom- The public officials and private parties testify- before the Subcommittee geographically ribed the respective watersheds and discussed: flood and water management problems, (2) oses and principal measures of watershed plans and (3) estimated costs of watershed rams. The Subcommittee was primarily con- ed with the agricultural aspects of the various rshed projects. (Powell-Florida)
-03787

HORITY TO THE SECRETARY OF ICULTURE TO MODIFY CERTAIN SES IN RE: RECREATIONAL FACILITIES ESERVOIR AREAS.
mittee on Agriculture (U.S. House). Subcom- e on Forest.

ings, Forest Lands, 87th Congress, 1st Sess., 7, 8 and 14, 1961, p 4-5.

riptors: *Legislation, *Leases, *Recreation ties, *Reservoirs, Forests, United States, st management, Construction, Maintenance, inistrative agencies, Operation, Water rces development, Jurisdiction, Legal aspects, al, Payment, Adjusted prices, Public benefits.

ings before the Subcommittee on Forests of louse Committee on Agriculture were held for urpose of considering H.R. 4934 to authorize Secretary of Agriculture to modify certain s entered into for the provision of recreation ties in reservoir areas. The bill related to s entered into by the Forest Service before mber 1, 1956, providing for the construction, tenance, and operation of commercial recrea- l facilities at water resource development pro- under the jurisdiction of the Secretary of culture. The bill would authorize the Chief of Forest Service, under the supervision of the tary of Agriculture, to amend such conces- ire leases to permit the adjustment of rental or other consideration payable to the United s under such lease. (Finman-Florida)
-03788

ABLISH THE OZARK SCENIC RIVER- S, CLARK NATIONAL FOREST, STATE ISSOURI.
mittee on Agriculture (U. S. House). Subcom- e on Forests.

ings, Forest Lands, 87th Congress, 1st Sess., 7, 8, and 14, 1961, p 6-130.

riptors: *Legislation, *National forests, *Mis- , *National recreation areas, Conservation, use, Recreation, Scenery, Natural resources, flow, Scenic easements, Agriculture, Legal ts, Forest management, Land resources, , Project purposes, Water resources develop- , Boundaries, Land, United States.

ngs on H.R. 6289 to establish the Ozark c Riverways in the Clark National Forest in ate of Missouri were held before the Subcom- e on Forests of the House Committee on ulture. The general purpose of the bill was to rve and develop for the use and enjoyment of the people of the United States the unusual recreational, scenic, and other natural and physical values along the Current and Eleven Point Rivers in the state of Missouri, including their preservation as free-flowing streams. The bill would obtain this objective by establishing the Ozark Scenic Riverways, to be administered by the Secretary of Agriculture as part of the Clark National Forest. The riverways would be generally comprised of relatively narrow strips of land along the Current and Eleven Point Rivers. Under the bill, the exterior boundaries of the Clark National Forest would be modified to include those portions of the designated riverways area lying outside the Forest's existing boundaries. Within the riverways, the Secretary of Agriculture would be authorized to acquire needed lands and interests in land, including scenic or conservation easements. (Finman-Florida)
W71-03789

STATUS OF PENDING WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).

Hearing, 90th Cong, 2d Sess, June 19, 1968, p 3-22.

Descriptors: *Watershed Protect. and Flood Prev. Act, *United States, *Water policy, *Multiple-purpose projects, Water resources development, Watershed management, Legislation, Legal aspects, Social aspects, Project benefits, Project planning, Project feasibility, Governments, Programs, Financing, Financial feasibility.
Identifiers: *Constitutionality.

A hearing before the House Committee on Agriculture was held to determine the status of pending watershed projects. Testimony was offered by the Deputy Director of the Bureau of the Budget, and the Assistant Secretary of Agriculture, with regards to pending programs authorized under the Watershed Protection and Flood Prevention Act. Testimony indicated that authorized watershed projects have been limited by: (1) inadequate financial appropriations, (2) President Johnson's decision not to seek a second term, and (3) President Johnson's attack on the constitutionality of the Watershed Protection and Flood Prevention Act. The Act provided that final approval for projects costing the federal government over $250,000 was vested in the House and Senate Agriculture Committees. The President contended that this privision endeavored to empower the legislative branch, or part of it, to participate in the execution of laws, a function vested by the Constitution in the executive branch. A list of pending watershed projects is set forth. (Powell-Florida)
W71-03790

WATERSHED PROJECTS.
Committee on Agriculture (U. S. House).

Hearings on Miscellaneous Subjects, 87th Cong, 1st Sess, Feb 15 and 16, 1961, p 3-87.

Descriptors: *Legislation, *Multiple-purpose projects, *Watersheds (Basins), *Water resources development, Flood protection, Project benefits, Project purposes, Project feasibility, Project planning, United States, Flood control, Legal aspects, Social aspects, Recreation, Water policy, Watershed management, Water utilization, River basin, Development, Cost sharing, Cost-benefit ratio, Financing, Costs, Federal government.

Hearings before the Committee on Agriculture were held to hear testimony advocating the approval of several watershed projects. The watershed projects involved were: Fishing Creek, South Carolina; Leatherwood Creek, Virginia; Marsh Creek, Kentucky; Tortugas Arroyo, New Mexico; Upper Josephine-Jackson, Florida; and Waianae Iki, Hawaii. Testimony was offered in favor of the respective projects by various public officials and private individuals, who discussed the economic, social and legal aspects of such watershed projects. The Committee hearing explored the financial aspects of watershed protection and flood prevention programs, including cost sharing, valuation of acreage, acquisition of rights-of-way, and construction, operation and maintenance costs. The Committee also investigated the estimated cost of the watershed projects for each acre benefited. (Powell-Florida)
W71-03791

LAW AND THE ENVIRONMENT.
Edited by Baldwin, Malcolm and Page, James K, Jr. New York, Walker and Co, 1970. 432 p, 738 ref.

Descriptors: *Legal aspects, *Water pollution, *Water law, *Environment, Ecology, Judicial decisions, Federal government, United States, Administrative agencies, Administrative decisions, Water pollution sources, Water pollution effects, Balance of nature, Environmental effects, Legislation, Wildlife, Remedies, Air environment, Aquatic environment, Adjudication procedure.

The main subdivisions of this book on environmental law include: (1) Problems of Litigation, (2) Needed Developments in the Laws, and (3) Opportunities and Mechanisms to Meet the Needs. The first subdivision discusses the Santa Barbara Oil Spill history, its current status, and future predictions. It also examines the use of expert witnesses in environmental litigation. In the second subdivision the following topics are discussed by various authors: (1) burden of proof, (2) standing to sue, (3) the constitutional right to a decent environment, (4) the trust doctrine, and (5) the governmental role in environmental litigation. The third subdivision is divided into three topics: (1) the attorney's role in environmental litigation, (2) law college programs in the environmental field, and (3) trends in developing the environmental curriculum. Each section is followed by a panel discussion of the topic among the various authors involved. (See also W71-03793 thru W71-03798) (Hart-Florida)
W71-03792

THE ROLE OF GOVERNMENT IN ENVIRONMENTAL CONFLICT,
Harold P. Green.
In: Law and the Environment, New York, Walker and Co 1970, p 235-247.

Descriptors: *Federal government, *Environmental effects, *Administrative agencies, *Legislation, Legal aspects, Public rights, Environment, Remedies, State governments, Social aspects, Administrative decisions, Pollution abatement, Ecology, Costs, Cost analysis, Balance of nature, Regulation, Administration.
Identifiers: *Ecological impact.

In this response to what the role of government should be in environmental conflict and how this role can be effectively played, it is suggested that private litigation cannot successfully defend the environment; hence, the government must intervene. The author suggests that government action may take three forms: (1) amicus curiae or intervenor; (2) legislation establishing environmental standards and prohibiting environmentally detrimental activities; and (3) regulatory legislation administered by an agency charged with establishing and enforcing environmental standards. Since each role requires legislation, the difficulty of inducing legislative action is examined. Determining that the fundamental problem in inducing legislation is the paucity of information available on the costs, risks, and adverse consequences of technological advancement, the author concludes that an ombudsman-type administrative agency should be established as an arm of Congress. The agency would be charged with the sole function of investigating, publicizing, and pressing upon Congress, the public, and the administrative agencies the potential adverse consequences involved in activities affecting the environment. (See also W71-03792) (Hart-Florida)
W71-03793

OUTLINE OF FEDERAL ENVIRONMENTAL LAW FOR THE PRACTICING LAWYER,
James Watt Moorman.
In: Law and the Environment, New York, Walker and Co 1970, p 182-234.

Descriptors: *Water pollution, *Legal aspects, *Environment, *Remedies, Water utilization, Federal government, Water pollution sources, Water pollution effects, Ecology, Balance of nature, Environmental effects, Highway effects, Wildlife, Judicial decisions, Air environment, Aquatic environment, Estuarine environment, Deserts, Legislation, United States, Administrative agencies, Administrative decisions.

The author's outline of federal environmental law for the practicing lawyer is divided into two major areas--procedural and substantive environmental matters. In the procedural portion, jurisdiction (with emphasis upon standing), discovery, and other matters such as burden of proof and evidence are examined. The substantive portion is subdivided into three parts: (1) pollution, (2) land and water use, and (3) the public domain. Under 'pollution', the author discusses: (1) water pollution, with emphasis upon the effect of federal legislation in the area; (2) air pollution; (3) pesticides; and (4) noise pollution. Under 'land and water use', the various means of combatting pollution of rivers, estuaries, and coastal waters are examined with respect to federal control and legislation. The means of combatting strip mining, highway routing, and fish and wildlife destruction are also discussed. In the subsection entitled 'the public domain', the author examines federal lands and parks, Alaska, the Outer Continental Shelf, and the Bureau of Land Management. (See also W71-03792) (Hart-Florida)
W71-03794

STANDING TO SUE IN CONSERVATION SUITS,
Louis L. Jaffe.
In: Law and the Environment, New York, Walker and Co 1970, p 123-133.

Descriptors: *Legal aspects, *Judicial decisions, *Public rights, *Administrative decisions, *Environment, Administrative agencies, Natural resources, Decision making, Federal government, Legislation, Water resources development, Remedies, Conservation.
Identifiers: *Standing to sue, Constitutional aspects.

The question considered by this chapter is: Who can initiate or participate in proceedings to preserve or improve environmental amenities. For this purpose, environmental action suits are categorized as either nuisance or non-nuisance actions. A private citizen cannot sue to enjoin a public nuisance without showing a particular injury; therefore, the public's right to abate a nuisance is normally enforced by public authorities. Because the public is often under-represented in administrative decisions, the public might seek judicial review of the decision. However, participation is severely inhibited by the constitutional case-or-controversy concept. Court decisions are analyzed, holding variously: (1) that a federal taxpayer has standing to contest federal expenditures in aid of religious activity; (2) that a conservation association is within the zone of interests protected by legislation requiring the FPC to consider the environmental impact of a power plant, and therefore has standing; (3) that television listeners are entitled to participate in both a hearing and review on the permit renewal of a TV station; and (4) that a party injured in fact and arguably within the zone of protected interests has standing to seek review of administrative action. The author concludes these decisions establish a general trend to liberalize the standing concept. (See also W71-03792) (Hart-Florida)
W71-03795

THE RIGHT TO A DECENT ENVIRONMENT: PROGRESS ALONG A CONSTITUTIONAL AVENUE,
E. F. Roberts.
In: Law and the Environment, New York, Walker and Co 1970, p 134-165.

Descriptors: *Environment, *Legal aspects, *Judicial decisions, *Public rights, Pollution abatement, Air pollution, Soil contamination, Water pollution, Thermal pollution, Legislation, Federal government, State governments, Community development, Environmental effects, Zoning, Eminent domain, Condemnation, Cities, Industries, Land use, Social aspects, Remedies, Ecology, Real property.
Identifiers: *Constitutional aspects.

Speculating upon whether a right to a decent environment can be found within the Bill of Rights of the United States Constitution, this chapter primarily analogizes to the development of the right to privacy. Since the right to a decent environment cannot be expressly found, the author posits that it must be within a penumbra of one of the other amendments, or impliedly found in the ninth amendment. The use of the zoning power to maintain a decent environment is discussed in some detail. Also, the use of the eminent domain power in conjunction with the concept of the 'new property' is analyzed as a means of improving our environment. Rejecting both the zoning power and property law changes as inadequate to satisfy the public's demand for a halt to environmental destruction, the author concludes that a Supreme Court decision styled after Griswold v Connecticut, 381 US 479 (1965), is a necessary predicate to securing an improved environment. Moreover, the author recommends prospective application, leaving to legislators the task of correcting existing violations of the right to a decent environment. (See also W71-03792) (Hart-Florida)
W71-03796

LAW IN ACTION: THE TRUST DOCTRINE,
Edward Berlin, Anthony Z. Roisman, and Gladys Kessler.
In: Law and the Environment, New York, Walker and Co , 1970, p 166-181.

Descriptors: *Reservation doctrine, *Environment, *Land use, *Public rights, Legal aspects, Judicial decisions, Pollution abatement, Real property, Land tenure, Air pollution, Soil contamination, Water pollution, Thermal pollution, Legislation, Federal government, Remedies, State governments, Community development, Environmental effects, Administrative agencies, Administrative decisions, Social aspects, Ecology.
Identifiers: *Constitutional aspects, *Trust doctrine.

Speculating on application of the trust doctrine to improve the environment and to prevent further deterioration, property is categorized into three types: (1) property owned by the government, (2) property privately owned and used consistently with public interest; and (3) property privately owned but used inconsistently with public interest. As to government-owned property, the author suggests that mandamus and similar remedies may be used to prevent use inconsistent with the public interest; he also suggests that the fifth amendment impliedly requires that government property be used only in the public interest. For property in the second category, it must be established that the trust has been in existence from the beginning of our constitutional government and that all property transfers have an implicit condition that it will be used in the public interest. Two alternatives are suggested for establishing public interest in property in category three: (1) a condemnation action to preserve the property for public benefit; and (2) a mandamus action, joining the landowner, to require condemnation for the public. Although admitting that the expanded concepts of the trust doctrine are radical, the author concludes that such expansion presents a viable possibility for advancement in the environmental area. (See also W71-03792) (Hart-Florida)
W71-03797

THE SANTA BARBARA OIL SPILL,
Malcolm F. Baldwin.
In: Law and the Environment, New York, Walker and Co 1970, p 5-47. 142 ref.

Descriptors: *Oil industry, *Administrative agencies, *Federal government, *Water pollution control, Water pollution sources, Water pollution effects, Oil, Water pollution, Pollutants, Environmental sanitation, Water pollution treatment, Administrative decisions, State governments, United States, Leases, Legislation, Rivers and Harbors Act, Submerged Lands Act, Oil fields, Natural gas, Exploitation, Legal aspects.
Identifiers: *Santa Barbara Oil Spill, Water Quality Improvement Act.

The Santa Barbara Oil Spill is a lesson to be remembered. Although the spill was relatively minor the effects were severe. Oil leasing began in the channel in 1965, following settlement of a jurisdictional dispute. The leases were subject to count pressures by the Budget Bureau and oil companies vis-a-vis the public. The varied federal statute procedures, and agencies failed to prevent the spi A post-mortem reveals that some requiremen were meticulously followed while others were o served only in form. After the spill, the Departme of the Interior established new regulations f drilling and exploration, and began to require lea ing companies to submit proprietary information the Department. The President's panel reco mending renewed pumping to stop leakage w severely criticized. Congress responded to the sp by enacting the Water Qaulity Improvement A providing strict liability for oil spills up to $8 m lion. However, the act does not affect drilling l bility beyond the three-mile limit. The constit tionality of the Act has been questioned, a several companies have asserted that it breach the leases. Other action for damages from the sp and injunctions to prevent future drilling, ha been filed. (See also W71-03792) (Hart-Florida)
W71-03798

ILLINOIS LAWS RELATING TO WATE WAYS, 1969.
Illinois State Dept. of Public Works and Buildin Springfield.

Springfield, 1970. 246 p.

Descriptors: *Legislation, *Inland waterwa *Water law, *Illinois, State governments, Strea Lakes, Navigable waters, Non-navigable wate Bridges, Boats, Canals, Administrative agenci Flooding, Flood control, Navigation, Watershe (Basins), Watershed management, Water cons vation, Cities, Parks, Water pollution, Le aspects, Federal government, Rivers.
Identifiers: Constitutions.

Consolidated into this single volume are the: (1) linois statutes pertaining to rivers, lakes, a streams; and (2) Illinois statutes relating to authority, duties, and jurisdiction of the Depa ment of Public Works and Buildings and its D sion of Waterways. Pertinent sections of the Illin constitution preface thw work. Additiona federal legislation has been furnished where it terrelates with included state legislation. Supp menting extensive special legislation pertaining specific rivers or flood control districts are laws general applicability. Some titles of acts in t latter category are: bridges; pure water board; b registration and safety; civil administration; co missions; counties; criminal laws; drainage; flo control; municipal code; nuisances; polluti refuse from outside the state; rivers, lakes a streams; sanitary districts; watershed protect and flood prevention; water terminals; wa authorities; and waterways. (See also W71-038 (Hart-Florida)
W71-03799

INOIS LAWS RELATING TO WATER-YS, 1967.
ois State Div. of Waterways, Springfield.

ngfield, 1968. 232 p.

criptors: *Illinois, *Legislation, *State govern-t, *Administrative agencies, Boats, Inland rways, Dams, Drainage districts, Flood protec- Harbors, Port authorities, Reservoir opera- Water resources development, Submerged ds Act, Water resources, Watershed manage-t, Water pollution control, Legal aspects, Ad-stration, Flood control, Interstate compacts, dings, Beds under water.
tifiers: Constitutions.

ented in this publication is a compilation of ted Illinois statutory and constitutional materi-ealing with rivers, lakes, streams, and other r bodies. Statutes defining the duties, authori-nd jurisdiction of the Illinois Department of ic Works and Buildings, and its Division of rways are provided, along with sections of the: ois Constitution, Illinois Revised statutes, Il-s Civl Administrative Code, Illinois Municipal e, Illinois Criminal Code, and certain interstate acts. The compilation encompasses such as: boat registration and safety, bridges, ds, dams, drainage and flood control districts, ors, port districts, pure water boards, reser-, resource development boards, and sanitary cts. Other statutory topics include: submerged , watersheds, water pollution, water rces, water terminals, and surface water pro-on. Only selected sections of the pertinent tes are provided, but references to the plete statutory provisions are included. (See W71-03799) (Earl-Florida)
-03800

ER QUALITY STANDARDS.
nia State Water Control Board, Richmond.

1970. 59 p.

riptors: *Virginia, *Standards, *Water quality ol, *Water quality, Legislation, Municipal , Domestic water, Legal aspects, Social ts, Public health, Recreation, Potable water, eation, Water treatment, Water pollution con-Municipal wastes, Sewage, Water resources.

nia Water Quality Standards are established e Virginia State Water Control Board. The ards first set forth include those rules with al state-wide application, including standards lished for the protection of public or mu-al water supplies and standards which apply at ater intake points. Next set forth are the rules specific application based on climate, geo-ical area, or uses. The primary classifications ters within the State are enumerated. Virginia quality standards apply to fourteen basin and n descriptions, including: (1) Big Sandy River , (2) Clinch River Basin, (3)Holston River , (4) New River Basin, (5) Roanoke River , (6) Chowan River Basin, (7) Shenandoah Basin, (8) Rappahannock River Basin, (9) River Basin, (10) James River Basin, (11) peake Bay and Atlantic Ocean, (12) Yadkin Basin, (13) Albermarle Sound, and (14) nac River Basin. A key to special standards is ded. (Powell-Florida)
03801

WATERS AND WETLANDS: HOW THE PS OF ENGINEERS CAN HELP PREVENT R DESTRUCTION AND POLLUTION.
e Comm on Gov't Operations. Committee on rnment Operations (U. S. House).

Cong, 2d Sess, HR Rep No 91-917. 18 p, 30

iptors: *Federal government, *Administra-gencies, *Administration, *Permits, Control, ation, Regulation, Governments, United States, Navigation, Navigable waters, Water pollution, Water pollution sources, Conservation, Institutions, Riparian rights, Coastal engineering, Coastal structures, Rivers and Harbors Act, Transportation, Industries, Wastes, Waste disposal.
Identifiers: *Corps of Engineers.

By the House Committee on Government Operations, this report deals with measures which can be taken by the Army Corps of Engineers to alleviate the unfavorable ecological impact of private construction in or about navigable waters. Emphasis is placed on the Corps' procedures for reviewing and approving applications for construction. The committee recommends that the Corps, rather than basing approval wholly on the public interests to be served in the areas of navigation and commerce, give more weight than in the past to the possible ecological effects of the private activity. It is recommended that harbor lines established by the Corps be regarded as mere guidelines instead of absolute limits within which construction would be permitted without application. The Committee recommends that the burden should be on the applicant to prove that proposed construction would not be damaging to the ecology. Furthermore, the Corps should vigorously enforce the Refuse Act of 1899, prohibiting the dumping of foreign substances into navigable waters. (Dye-Florida)
W71-03802

THE LAW OF INTERNATIONAL WATERWAYS,
R. R. Baxter.
The Law of International Waterways, Harvard Univ Press, Cambridge, Mass, 1964. 371 p, 2 tab, 1,118 ref, append.

Descriptors: *International waters, *Foreign waters, *Canals, *International law, Channels, St Lawrence Seaway, Panama Canal, Canal zone, Navigation, Regime, Water conveyance, Administration, Political aspects, Governments, Legal aspects, Judicial decisions, United States, International commissions, Legal aspects.
Identifiers: *International waterways, Interoceanic canals.

Those rivers, canals, and straits used to a substantial extent by commercial shipping or warships belonging to nations other than the riparian nation are international waterways. Discussing the international law relating to such waterways, major divisions of this book include: (1) operating agencies for international waterways, (2) passage of ships in peacetime, (3) passage of ships in wartime, (4) legal controls in the fiscal sphere, (5) technical problems of administration of international waterways, and (6) international administration of international canals. Five means of operating an international waterway are discussed: (1) administration by a private company (Suez Canal); (2) operation of an interoceanic canal by a foreign sovereign (Panama Canal); (3) operation of interoceanic canals by a territorial sovereign (Kiel and Suez Canals); (4) international cooperation (St Lawrence Seaway); and (5) international administration through international commissions. In an appendix, articles on the navigation of international canals are proposed as a model codification of existing customary law of international waterways. Emphasis is placed upon interoceanic canals. (Hart-Florida)
W71-03803

NATURAL RESOURCES IN THE GOVERNMENTAL PROCESS A BIBLIOGRAPHY SELECTED AND ANNOTATED,
Arizona Univ., Tucson. Inst. of Government Research.
David F. Paulsen.
Tucson, University of Arizona Press, 1970. 99 p.

Descriptors: *Bibliographies, *Publications, *Reviews, *Natural resources, Economics, Forests, Water resources, Water resources development, River basins, Federal government, Grants, Research and development, Water pollution, Decision making, Social aspects, Flood control, Reclamation, Resources development, Resources, Conservation, Governments, Fishing, State governments, Water conservation, Water policy.

A selected and annotated bibliography of the literature relating to governmental action in the field of natural resources, this book summarizes the literature, assesses trends, and evaluates the potential for further development in the area. Chapter two catalogues literature dealing with social theory and policy formation in the natural resources area. Chapter three examines basic natural resources literature including: fishing, minerals, natural resources of the ocean, and soil conservation. Chapter four emphasizes studies concerned with the governmental development of specific river basins. Chapter five catalogues works concerning: (1) water policy-formation processes; (2) reclamation, dams, and flood control; (3) water systems of state and local government; and (4) water pollution. References are listed alphabetically under each topic, and an index to the authors of the catalogued work follows the text. (Barnett-Florida)
W71-03804

A SURVEY OF NEW HAMPSHIRE WATER LAW,
New Hampshire Univ., Durham. Water Resources Research Center.
Alexander J. Kalinski, and Robert H. Forste.
Available from NTIS as PB-197 122, $3.00 in paper copy, $0.95 in microfiche. WRRC Bulletin 3, July 1970. 42 p, 46 ref. OWRR Project A-011-NH (4).

Descriptors: *New Hampshire, *Riparian rights, *Judicial decisions, *Water law, Legal aspects, Riparian land, Usufructuary right, Reasonable use, Remedies, Riparian waters, Alteration of flow, Competing uses, Natural use, Obstruction to flow, Surface waters, Drainage water, Repulsion (Legal aspects), Riddance (Legal aspects), Surface runoff, Groundwater, Percolating water, Reservation doctrine, Eminent domain, Condemnation, Compensation.

The two objectives of this survey are to describe the development of the common law riparian doctrine of New Hampshire and to examine water resources actions of recent years. Six aspects of the New Hampshire riparian doctrine are discussed: (1) the general extent of the riparian right, (2) the riparian owner, (3) riparian land, (4) doctrinal development, (5) surface waters, and (6) groundwaters. Various New Hampshire supreme court decisions bearing on these aspects are analyzed in depth. The recent water resources actions discussed include: (1) nuisance abatement; (2) the public trust doctrine; (3) private exercise of eminent domain; and (4) mandamus. New Hampshire supreme court decisions pertaining to these actions are examined. (Hart-Florida)
W71-03805

WATER FOR ILLINOIS - A PLAN FOR ACTION.
Illinois State Technical Advisory Committee on Water Resources, Springfield.
For primary bibliographic entry see Field 04A.
W71-03806

RESTORING THE QUALITY OF OUR ENVIRONMENT.
President's Science Advisory Committee, Washington, D.C. Environmental Pollution Panel.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20404, Price $1.25. Report of the Environmental Pollution Panel, President's Science Advisory Committee, Washington, D.C, Nov 1965. 317 p, 11 append.

Descriptors: *Investigations, *Pollutant identification, *Federal government, *Environmental effects, Integrated control measures, Waste identification, Regulation, State governments, Local governments, Interstate, Water pollution sources, Water pollution control, Water resources development, Dredging, Municipal sewage, Salinity, Mine wastes, Domestic wastes, Public health, Interstate compacts, Legal aspects, Effluents, Political aspects, Project planning, Water pollution effects.

Recommendations for federal, state, and local action to restore the quality of the environment are set forth in this comprehensive appendixed examination of the effects and sources of pollution. The study encompasses the: (1) health effects of pollution, (2) polluting effects of detergents, (3) deterioration of materials and urban environments, and (4) climatic effects of pollution. The sources of pollution considered in this study are: (1) municipal and industrial sewage, (2) animal wastes, (3) mining wastes, (4) consumer wastes, and (5) unintentional releases of pollutants. Actions are proposed in twenty-eight areas of environmental concern. Among the proposals in the establishment of interstate compacts and entities to protect coastal marshes, lagoons, estuaries, river basins, and other water resources. Other proposals of the panel include: (1) a system of 'effluent charges' on polluters, (2) the creation of governmental groups to deal with outmoded sewerage systems, (3) the denial of federal funds for construction not minimizing dust and sediment in watersheds; (4) the consideration of salinity problems in agricultural planning, and (5) an examination of the environmental effects of granting dredging permits. The report also recommends programs in the areas of base-line measurement, development and demonstration of pollution control technology, research, and manpower. (Earl-Florida)
W71-03807

FLORIDA'S WATER RESOURCES (ASSESSMENT OF LEGAL CHANGES NECESSARY TO UTILIZE FULLY FORIDA'S WATER RESOURCES.
Florida Water Resources Study Commission, Gainesville.

Florida's Water Resources, Florida Water Resources Study Commission, Gainesville, Fla, Dec 1956. 91 p, 46 fig, 9 tab, 99 ref.

Descriptors: *Florida, *Water resources, *Water policy, *Water resources development, Water quality, Water supply, Water pollution, Hydrologic cycle, Surface water, Groundwater, Natural resources, Water utilization, Public rights, Legislation, Administration, Riparian rights, Topography, Streams, Water pollution control, Erosion, Administrative agencies, State governments, Legal aspects.

By the Florida Water Resources Study Commission, this report to the governor and the legislature gives an overall evaluation of the state's water resources and the problems and needs facing the state. Chapter 1 outlines water problems of Florida and provides a county-by-county assessment of: (1) diffused surface water; (2) streams, lakes and canals; (3) groundwater; and (4) tidal waters. Chapter 2 discusses existing water laws of Florida. Subjects include: (1) the riparian system, (2) navigability and governmental powers, (3) drainage legislation, (4) pollution control legislation, (5) diffused surface waters, (6) groundwaters and (7) the interrelationships between waters in different categories. Solution of legal problems is discussed. Chapter 3 gives facts about Florida's water resources. Chapter 4 discusses present water resources programs. Local, state, educational, and federal agency activities receive attention. Chapter 5 summarizes findings and conclusions and evaluates the adequacy of resources, the state of law, and water quality. Chapter 6 outlines commission recommendations, which include: (1) enactment of a comprehensive water law, preserving insofar as possible existing rights of Florida water users; and (2) establishment of an agency to administer the new law and insure optimum utilization of state water resources. (Duss-Florida)
W71-03843

6F. Nonstructural Alternatives

PRELIMINARY REVIEW AND ANALYSIS OF FLOOD CONTROL PROJECT EVALUATION PROCEDURES,
INTASA, Menlo Park, Calif.
N. V. Arvanitidis, R. L. Lind, J. Rosing, and G. P. Johnson.
Available from NTIS as AD-713 482, $3.00 in paper copy, $0.95 in microfiche. U.S. Army Engineer Institute for Water Resources Final Report No IRR-70-01, IWR-70-3 Sept 1970. 131 p, 28 fig, 13 tab, 10 ref. Contract DACW07-70-C-0050.
Identifiers: *Floods, Control, Protection, Damage, Management planning, Simulation, Costs, Terrain, Law, Maintenance, Economics, Statistical analysis, Reviews. *Flood control, Flood plain management, Land enhancement.

The study clarifies the economic consequences and effects of programs designed to protect or otherwise manage flood plains. A firm basis is established to appropriately distinguish between the source of change of a flood plain development from its economic effects. Alternative techniques for the measurement of benefits are presented. Where the development in the flood plain will be the same with and without the project, benefits attributable to the project will equal total damages reducee. Where there is project induced growth, the benefits attributable to the project are equal to the net increase in productivity of the economy due to the relocation of activities both inside and outside the flood plain. Benefits from project induced growth (so-called 'land enhancement' benefits) can be measured by the difference between the net income (profits) of activities which move into the flood plain with protection and the net income they could earn outside the flood plain. In the absence of direct observation of change in net income, benefits from project induced growth can be measured in terms of simulating damages reduced to new activities that would locate in the flood plain with protection.
W71-03531

NON-STRUCTURAL METHODS OF FLOOD-PLAIN MANAGEMENT: IDENTIFICATION, EVALUATION, AND SELECTION,
Illinois Univ., Urbana.
William Eugene Fraser.
M Landscape Arch Thesis, Illinois University, 1970. 73 p, 10 fig, 3 tab, 80 ref. OWRR Project A-030-ILL (1).

Descriptors: *Non-structural alternatives, *Flood protection, Flood plain zoning, Land use, Legal aspects, Planning, Water management (Applied), Regulation, Flood plain insurance, Zoning, Taxes.
Identifiers: *Flood plain management.

Non-structural methods of floodplain management are listed. Various methods were evaluated as to their suitability for reducing flood damages, and a process of selecting one or several of the methods that best meet the needs of the individual, agency, or community was developed. Non-structural methods of floodplain management can be arranged into three general groups: (1) methods to protect the health and safety of the floodplain residents, (2) methods to inform the floodplain residents of the flood hazards, and (3) methods to regulate the development on the floodplains. (Knapp-USGS)
W71-03730

A UNIFIED NATIONAL PROGRAM FOR MANAGING FLOOD LOSSES.
Task Force on Federal Flood Control Policy, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-03773

6G. Ecologic Impact of Water Development

A WATER RESOURCES ECOLOGY CAPABI-TY FOR THE WATERWAYS EXPERIME STATION AND CORPS OF ENGINEERS,
Army Engineer Waterways Experiment Stati Vicksburg, Miss.
For primary bibliographic entry see Field 09C.
W71-03318

ARTHROPOD ABUNDANCE IN COTTON RELATION TO SOME CULTURAL MANAG MENT VARIABLES,
California Agriculture Experiment Station, Davi
T. F. Leigh, D. W. Grimes, H. Yamada, J. R. Stockton, and Dick Bassett.
Tall Timbers Conference On Ecological Anim Control By Habitat Management, Tallahass Florida, Proceedings, p 71-83, February 27-1969. 9 fig, 12 ref.

Descriptors: *Cotton, *Agronomy, *Nitrogen, rigation effects, *Insects, Insect control, Mi Arid climates, California, On-site data collectio Irrigation practices, Ecology, Fertilizers, Pest c trol, Water distribution (Applied), Water utili tion, Animal behavior, Animal populations, vironmental effects, Temperature, Ecosyste Humidity, Crops, Microenvironment, C response, Sampling, Southwest U.S., Plant growt Identifiers: *Arthropods, *Crop pests, Spi mites.

The arid Southwest irrigation and N-fertilizers h very strong influences on growth and fruiting cotton plants. Temperature and humidity wit the canopy are also affected. Insects respond ferentially to environmental changes and therefo the effects of water and N variables on the c ecosystem should elicit responses in insect popu tions. In 2 different seasons (1962 and 1968) an 2 different southern California locations, cot plots were treated with factorial combinations o rigation schedules and N-application. At the en the growing season, measurements were made plant heights and populations of spider mites, ly bugs (Lygus hesperus knight) and predatory eyed bugs (Geocoris pallens Stal). Three-dim sional graphs of N and water applications and fi measurements were constructed. Increase in eit management variable produced increases in pl growth. Highly significant differences in ins numbers between some treatments were dem strated, indicating strong correlations betw phytophagous insect abundance and agronor practices. All results are preliminary and not c clusive. (Casey-Arizona)
W71-03342

SOME CONSIDERATIONS FOR WAT QUALITY AND ENVIRONMENTAL PROTI TION IN WILD AND SCENIC RIV DEVELOPMENT: THE CHATTOOGA RIVE A CASE STUDY,
Forest Service (USDA). Southern Region.
For primary bibliographic entry see Field 05G.
W71-03388

WHAT IS CONSERVATION,
Resources for the Future, Inc. Washington, D.C
For primary bibliographic entry see Field 06B.
W71-03639

'. RESOURCES DATA

A. Network Design

OMORPHOLOGY AT THE CENTRAL ARID NE RESEARCH INSTITUTE, INDIA,
ernational Inst. for Aerial Survey and Earth ences, Delft (Netherlands).
T. Verstappen.
ture and Resources, Vol 4, No 3, p 6-9, Sepber 1968.

scriptors: *Surveys, *Geomorphology, *Arid ds, *Aerial photography, *Data collections, ers, Meanders, Hydrology, Weathering, inage systems, Alluvium, Granites, River ns, River flow, Dunes, Sands, Environmental cts, Flood plains, Erosion, Geological surveys, drogeology, Land forming, Regional analysis, uctural geology, Terrain analysis, Topography, a processing, Hydrologic data, Maps, Research lities.
ntifiers: *India, *Block development surveys.

Central Arid Zone Research Institute AZRI) currently has 5 divisions with 2 more nned. In one of the largest, the Basic Resources lies Division, block studies are central to data mulation and map construction and are fol-ed by full integration between the studies and r immediate use. Geomorphology has been gnized as a key factor and stereoscopic studies erial photographs have been extensively unaken. Some important geomorphological arch projects currently in progress are: (1) ntation and geomorphology of dunes/sand ns involving moisture retention and grain cetation, (2) quantitative geomorphology of nage basins, linking geomorphology to hydrolond obtaining estimates of river load and runoff, river meandering behavior leading to practical iderations for bridge building, (4) former nage channels which give insights into current ity and subsurface water distributions and (5) itic weathering and its resulting effects on surwater infiltration. Much of the work is extenly interdisciplinary. Recommendations are e for future studies. (Casey-Arizona)
-03339

AR RADIATION AND THE USE OF IT BY NTS,
Geophysical Observatory, Leningrad SR).
primary bibliographic entry see Field 02I.
-03344

TRUMENTATION AND DEVELOPMENT OF HNIQUES TO MEASURE AND EVALUATE EOROLOGICAL PARAMETERS IMPORT TO HYDROLOGY,
Water Research Lab., Logan.
ne G. Chadwick.
lable from NTIS as PB-196 726, $3.00 in r copy, $0.95 in microfiche. Utah State ersity Water Research Laboratory Report WRR 12-1, November 1, 1970. 39 p, 36 fig, 8 ppend. OWRR Project A-002-UTAH (3).

riptors: *Telemetry, *Hydrologic data, *Gagtations, *Data transmission, Instrumentation, pitation gages, Snow surveys, Data collec- Computers, Measurement, Analog compu-Snowpacks, Water yield.
ifiers: *Snow depth gages, *Water content w).

ydrologic data telemetering system was ned to have the highest accuracy of any M telemetering system known. The repeata- of readout approaches 0.05%. This accuracy appreciably deteriorated in the presence of noise levels in radio telemetry transmissions. igh accuracy is obtained by: (a) a frictionless ducer; (b) a specially designed tracking filter; (c)a wide-range frequency deviation of plus or minus 40% permitting greater resolution and accuracy; (d) readout subsequently converted to usable units by aid of a digital computer; and (e) locating the electronics and the transducer in a temperature stable environment, underground. The frictionless transducer technique was used in developing a low-displacement type pressure transducer for measuring the water-content of snow. A method was developed for the automatic plotting of isohyetal lines on an analog computer. (Knapp-USGS)
W71-03375

BRIDGER INSTRUMENT MODIFICATION,
Montana State Univ., Bozeman. Water Resources Research Center.
Duain Bowles.
Available from NTIS as PB-196 727, $3.00 in paper copy, $0.95 in microfiche. Montana University Joint Water Resources Research Center Report No 2, September 1966. 30 p. OWRR Project B-006-MONT (1).

Descriptors: *Instrumentation, *Telemetry, *Data transmission, Water levels, Thermometers, Data collections, Weather data, Electronic equipment, Snow cover, Calibrations, Network design, Snowpacks, Computers, Data processing.
Identifiers: *Bridger (Mont), Weather data telemetry, *Telemetry networks.

Modifications were designed for operation on the Belfort Universal Raingage, the Leopold-Stevens Water level Recorder, and the Belfort Recording Microbargraph. In addition, thermistor thermometers were constructed to operate at the research areas thermograph locations. Specifically, the modifications were designed to permit electrical interrogation of existing devices now being operated at the Bridger, Montana research area to provide a resistive readout. Calibration tests were conducted to verify that the instrument modifications met the design requirements. Corrections for temperature effects upon the various potentiometers can be made in analysis of the data or on site by installation of a compensation device such as a thermistor. (See also W71-03377 thru W71-03379) (Knapp-USGS)
W71-03376

BRIDGER HYDROMETEOROLOGICAL RESEARCH AREA AND FACILITIES,
Montana State Univ., Bozeman. Water Resources Research Center.
R. J. Rickabaugh.
Available from NTIS as PB-196 728, $3.00 in paper copy, $0.95 in microfiche. Montana University Joint Water Resources Research Center Report No 4, January 1967. 26 p. OWRR Project B-006-MONT (2).

Descriptors: *Instrumentation, *Telemetry, *Data transmission, Water levels, Thermometers, Data collections, Weather data, Electronic equipment, Snow cover, Calibrations, Network design, Snowpacks, Computers, Data processing.
Identifiers: *Bridger (Mont), Weather data telemetry, *Telemetry networks.

The Bridger Hydrometeorological Research Area, University of Montana, is located 20 miles north of Bozeman on Highway 293, on the east slope of the Bridger Mountain Range. There are now over 225 miles of insulated copper conductor in this area for collection and transmittal of field data. This outdoor laboratory overlaps the Bridger Bowl ski area. The cable complex fans out from the 'Bridger Data Center', a building located near the center of the complex at about 6,500 ft. elevation. It is accessible by car in any season of the year. The electronics equipment converts the incoming data from research sites into coded form for transmission to the campus. The remote control for the transmitter that transmits digital information to the University is also located in this building. Meters at this location give wind speed and direction at the ridge of the mountain range, half way up the slope, and at the data center. On the ridge of the range the University built a 10' x 12' 'A' frame shelter fully insulated and having commerical power for heat, lights, etc. It is also a terminal for a 100 conductor cable originating one mile down the slope in the Data Center. A transmitter located here is part of the telemetry system. Commercial power can be extended from this point to other locations on the ridge. (See also W71-03376) (Knapp-USGS)
W71-03377

BRIDGER TELEMETRY COMMUNICATIONS SYSTEMS,
Montana State Univ., Bozeman. Water Resources Research Center.
Robert E. Leo.
Available from NTIS as PB-196 729, $3.00 in paper copy, $0.95 in microfiche. Montana University Joint Water Resources Research Center Report No 5, January 1967. 11 p, 13 fig. OWRR Project B-006-MONT (3).

Descriptors: *Instrumentation, *Telemetry, *Data transmission, Water levels, Thermometers, Data collections, Weather data, Electronic equipment, Snow cover, Calibrations, Network design, Snowpacks, Computers, Data processing.
Identifiers: *Bridger (Mont), Weather data telemetry, *Telemetry networks.

The Bridger Telemetry Communications System provides Frequency Modulation (FM), Very high Frequency (VHF), radio equipment in order to transmit digital hydrometeorological data from the Bridger Mountain area north of Bozeman, Montana, to the Electronics Research Laboratory on the campus of Montana State University, Bozeman, Montana. Either a voice or data mode may be used. The voice mode may be used to communicate in both directions over the link for maintenance purposes and in normal operations is very seldom used. The data mode provides for transmission on 171.9 MHz of digital data in one direction only -- from Bridger to ERL. The equipment is entirely 110 volt AC operated at the ERL end of the link and at the Bridger Data Center. The ridge transmitter is operated from a 12 volt car battery which is kept charged from a trickle charger. (See also W71-03376) (Knapp-USGS)
W71-03378

BRIDGER HYDROMETEOROLOGICAL DATA ACQUISITION SYSTEM,
Montana State Univ., Bozeman. Water Resources Research Center.
Lee E. Cannon.
Available from NTIS as PB-196 730, $3.00 in paper copy, $0.95 in microfiche. Montana University Joint Water Resources Research Center Report No 6, February 1967. 32 p, 3 append. OWRR Project B-006-MONT (4).

Descriptors: *Instrumentation, *Telemetry, *Data transmission, Water levels, Thermometers, Data collections, Weather data, Electronic equipment, Snow cover, Calibrations, Network design, Snowpacks, Computers, Data processing.
Identifiers: *Bridger (Mont), Weather data telemetry, *Telemetry networks.

The Data Acquisition System installed at Bridger Bowl, Montana, was designed and constructed to record a wide variety of hydrometeorological parameters in a computer compatible form. The system consists of power supplies to operate the system; digitizers; even counters; programmable scanner and clock; controller to accept signals from the digitizers, the event counters, the scanner, and the clock, and to generate the output record; and the terminal board. The system is capable of interrogating up to 99 channels of information. Of these, any five may be connected to the five 3-digit event counters. Any parameter which can be normalized in the 0-300 microampere range can be recorded by the system. (See also W71-03376) (Knapp-USGS)
W71-03379

RELIABILITY OF A VARIANCE ESTIMATE OBTAINED FROM A SAMPLE AUGMENTED BY MULTIVARIATE REGRESSION,
Geological Survey, Arlington, Va.
E. J. Gilroy.
Water Resources Research, Vol 6, No 6, p 1595-1600, December 1970. 6 p, 3 ref.

Descriptors: *Regression analysis, *Date collections, *Sampling, *Networks, Gaging stations, Hydrologic data, Statistical methods, Variability.
Identifiers: *Multivariate regression.

A sample augmented by multivariate regression estimates was used to estimate the population variance associated with the sample. The sampling variance of the estimator obtained from the lengthened sample was derived and compared with the sampling variance computed from the original unaugmented sample. The relative reliability of the variance estimate based on the original observations is found to depend on the multiple correlation between the original and the augmenting variables. One application of these results is found in the design of gaging station networks. Given an existing set of gaging stations and faced with the decision of which subset of stations to retain, the network designer may wish to give consideration to estimating both the mean and the variance at the discontinued sites. A discontinued site would then correspond to the variable with the short sample record. The results given will aid in this decision making process. (Knapp-USGS)
W71-03675

COMPARING POWER SPECTRA COMPUTED BY BLACKMAN-TUKEY AND FAST FOURIER TRANSFORM,
United States Lake Survey, Detroit, Mich.
For primary bibliographic entry see Field 02E.
W71-03676

ESTIMATION OF BASIN PRECIPITATION BY REGRESSION EQUATION,
Meteorological Service of Canada, Toronto (Ontario).
For primary bibliographic entry see Field 02B.
W71-03691

ON TESTING THAT THE DISTRIBUTION OF EXTREMES IS OF TYPE I WHEN TYPE II IS THE ALTERNATIVE,
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 02E.
W71-03697

7B. Data Acquisition

INSTRUMENTATION AND DEVELOPMENT OF TECHNIQUES TO MEASURE AND EVALUATE METEOROLOGICAL PARAMETERS IMPORTANT TO HYDROLOGY,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 07A.
W71-03375

BRIDGER INSTRUMENT MODIFICATION,
Montana State Univ., Bozeman. Water Resources Research Center.
For primary bibliographic entry see Field 07A.
W71-03376

BRIDGER HYDROMETEOROLOGICAL RESEARCH AREA AND FACILITIES,
Montana State Univ., Bozeman. Water Resources Research Center.
For primary bibliographic entry see Field 07A.
W71-03377

BRIDGER TELEMETRY COMMUNICATIONS SYSTEMS,
Montana State Univ., Bozeman. Water Resources Research Center.
For primary bibliographic entry see Field 07A.
W71-03378

BRIDGER HYDROMETEOROLOGICAL DATA ACQUISITION SYSTEM,
Montana State Univ., Bozeman. Water Resources Research Center.
For primary bibliographic entry see Field 07A.
W71-03379

THE USE OF FALLOUT CESIUM-137 AS A TRACER OF SEDIMENT MOVEMENT AND DEPOSITION,
Agricultural Research Service, Oxford, Miss., Sedimentation Lab.
Jerry C. Ritchie, J. Roger McHenry, Angela C. Gill, and Paul H. Hawks.
In: Proceedings Water Resources Conference, Mississippi State University, State College, April 14-15, 1970, published by Mississippi State Univ Water Resources Research Institute, p 149-162, 1970. 14 p, 3 fig, 2 tab, 13 ref. OWRR Project A-999-Miss (6).

Descriptors: *Tracers, *Tracking techniques, *Sediment transport, *Fallout, *Tagging, Mississippi, Silting, Provenance, Reservoir silting, Sediment yield, Soil erosion, Deposition (Sediments), Cesium.
Identifiers: *Sediment movement tracers.

Radioactive fallout tags soil particles with identifiable radioisotopes so that movement of these particles can be followed through the sedimentation process. The content of cesium-137, a gamma emitter (0.662 Mev) and a fallout product, was determined in a number of selected soils and sediments from the Little Tallahatchie River Watershed above Sardis Dam, Mississippi. The variation in measured concentrations of cesium-137 in sediment profiles can be related to periods of maximum fallout. The age of the upper sediments and the rate of deposition can be estimated. A greater depth and rate of sediment accumulation were found in the deeper parts of the reservoir area sampled. The recent (1963-69) rate of sedimentation is less than in prior years (1959-63). Soils under forest cover contain more cesium-137 than those under grass. Where soils have eroded, cesium-137 content is less. The cesium-137 content is less in sandy soils than in finer textured soils because of the differences in ion exchange capacity of the soils. (See also W71-03380). (Knapp-USGS)
W71-03385

INTERFERENCE STUDIES IN THE DETERMINATION OF SODIUM, POTASSIUM, CALCIUM, AND MAGNESIUM IN NATURAL WATERS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Agricultural Research Service, Oxford, Miss., Sedimentation Lab.
For primary bibliographic entry see Field 02K.
W71-03386

A NEW SIMPLIFIED INSTRUMENT FOR WATER TEMPERATURE MEASUREMENTS,
Swedish Meteorological and Hydrological Inst., Stockholm.
Oscar Cabelis.
Nordic Hydrology, Vol 1, No 4, p 209-215, 1970. 7 p, 6 fig, 4 ref.

Descriptors: *Water temperature, *Bathythermographs, *Thermometers, Instrumentation, Depth, Equipment, Measurement, Calibrations.
Identifiers: *Thermistors.

Through the rapid development in the field of electrotechniques and the development of highly sophisticated precision components it has been possible to design a new simplified electrical instrument for the measurement of water temperature. This instrument consists of a bridge, a thermistor probe with leads, and a galvanometer. The instrument has been used for five years under extreme weather conditions. The instrument has shown very relia readings. The most recent version of the probe r be used in salt water at depths as great as 200 ters. Measurements can probably be made c siderably deeper with good reliability. (Kna USGS)
W71-03391

SEISMIC REFRACTION AND ELECTRIC RESISTIVITY: TOOLS IN GROUNDWAT EXPLORATION,
Iowa State Univ., Ames. Dept. of Earth Science.
Lyle V. A. Sendlein.
American Society of Agricultural Engine Transactions, Vol 11, No 6, p 890-892, 1968. 3 fig, 7 ref. OWRR Project A-012-IA (2).

Descriptors: *Seismic studies, *Electrical stud *Geophysics, *Surveys, *Electrical well logg Groundwater, Water resources developm Aquifers, Water quality, Resistivity.
Identifiers: *Groundwater exploration.

The coordinated use of geophysics and geology plied to groundwater problems helps provide m imum geologic information from a minimum vestment. The reliability of the study depends data density, which is related to the amount money invested in the study. A coordinated proach will also supply more information per do invested than a study composed of bore-hole in mation alone. Application of geophysical meth without additional geologic information redu the level of reliability of geophysical data. (Kna USGS)
W71-03439

A CONTROLLED DEPTH, VOLUMETRIC B TOM SAMPLER,
For primary bibliographic entry see Field 05A.
W71-03449

AN EVALUATION OF THE INFRA-RED TH MOMETER AS AN AIRBORNE INDICATOR SURFACE WATER TEMPERATURES,
Department of Transport, Toronto (Ontar Meteorological Branch.
T. L. Richards, and D. G. Massey.
Manscript, October 29, 1965. 24 p, 14 fig, 7 ta ref.

Descriptors: *Water temperature, *Infra-red ra tion, *Evaporation control, *Weather d Meteorology, Remote sensing, Evaporation, La Reservoirs, *Great Lakes, Lake Ontario.
Identifiers: *Infra-red thermometer, *Airbo radiation thermometer.

Obtaining data on surface water temperatures i value to many uses. It is most useful for forecas meteors logical conditions over the lakes and t adjacent land areas and for assessing water lo through evaporation and in studies of the forma and dissipation of ice. An infra-red thermom (IRT) was installed on an aircraft as an airbo radiation thermometer (ART) and subjected program of test and evaluation as an instrumen these measurements over the Great Lakes. The phase of the program dealt with the mounting exposure of the sensor. The second, in conjunc with the research vessel 'Poste Dauphine' d mainly with operational and theoretical aspect the technique. It is concluded that, although the posure of the sensor is critical, the ART, when i in suitable weather and with proper calibra checks, provides a good technique for making and reliable water temperature surveys of the G Lakes. The optimum height for such surveys pears to be 500 feet or lower; however, if nece ry, flights at one or two thousand feet appear t feasible with proper calibration. Absolute and tive accuracies appear to be of the orders of 1.0 C and 0.5 deg C respectively. (Herrera-Vander
W71-03466

MPLING CONSIDERATIONS IN STREAM CHARGE AND TEMPERATURE MEASURE-NTS,
sburgh Univ., Pa.
G. Quimpo, and J. Y. Yang.
ter Resources Research, Vol 6, No 6, p 1771-4, December 1970. 3 fig, 10 ref.

criptors: *Sampling, *Temperature, *Time se- analysis.
ntifiers: Auto correlation coefficient, Stream harge, Time interval.

choice of a sampling interval in hydrometry is strained by two extremes, redundant informa- from sequentially correlated observations lting from sampling too often, and lost informa- because of too infrequent sampling. The varia- y of the sample variance is used to obtain a pling interval at some level of information ndance. This statistic is suggested as an alter- ve measure of information content to the one d on the variance of the sample mean time se- of stream discharge and temperature measure- ts are used to illustrate application of the ry. While the data treated were confined to amflow and temperature, the technique may be ied to other variables in water resources. (U- nyaya-Vanderbilt)
-03476

AR MEASUREMENT OF PRECIPITATION E,
onal Science Foundation, Washington, D.C. ial Foreign Currency Science Information Pro- n.
I. Borovikov, V. V. Kostarev, I. P. Mazin, V. I. nov, and A. A. Chernikov.
slation of Radiolokatsionnye Izmereniya lkov. Leningrad, 1967. Available from NTIS as 9-55101, $3.00 in paper copy, $0.95 in ofiche. Israel Program for Scientific transla- , Jerusalem, 1970. 112 p.
tifiers: *Meteorological radar, Precipitation teorology), *Precipitation (Meteorology), surement, Radio waves, Attenuation, Reflec- Radar detection, Radar equipment, Radar s sections, Radar signals, Microstructure, Er- Accuracy, Data processing, USSR, Transla- .

nods of radar measurement of precipitation: ical principles of the measurement of ipitation by the radar signal intensity; Equip- and procedure for obtaining radar precipita- data; Observational procedure and data essing: Results of comparative observations.
-03527

ORTABLE, AUTOMATIC WATER SAM-R,
st Service (USDA), Ogden, Utah. Intermoun- Forest and Range Experiment Station.
rt D. Doty.
r Resources Research, Vol 6, No 6, p 1787- , December 1970. 2 p, 2 fig.

riptors: *Automation, *Sampling, *Water ty, Chemical analysis, Equipment, Instrumen- n.
ifiers: *Automatic water-samplers.

ter sampler is designed to operate where no de source of power is available and where ac- to the point of sampling is difficult. The sam- s lightweight, battery powered, and automati- bottles 16 samples at present time intervals een servicings. (Knapp-USGS)
-03695

LT TRACING METHOD FOR MEASUR- CHANNEL VELOCITIES IN SMALL NTAIN STREAMS,
e Univ., Orono; and Sleepers River Research rshed, Danville, Vt.
l Calkins, and Thomas Dunne.
Journal of Hydrology, Vol 11, No 4, p 379-392, November 1970. 14 p, 5 fig, 2 tab, 18 ref.

Descriptors: *Discharge measurement, *Tracers, *Tracking techniques, *Small watersheds, *Stream gages, Electrolytes, Saline water, Mixing, Water storage, Hydrograph analysis, Velocity, Channel morphology, Discharge (Water), Rainfall-runoff relationships, Vermont.
Identifiers: Experimental watersheds.

Because measuring or calculating channel velocities in small mountain streams is very difficult due to the high variability of the channel geometry parameters and roughness characteristics, a salt tracing procedure was examined. The technique is simple and quick, using materials that are commonly available at most research watersheds and water resource centers. The velocity through the channel reach using the salt tracing method was found to be a better representation of the average stream velocity than that computed by the continuity equation at three channel cross sections. (Knapp-USGS)
W71-03700

REMOTE RECORDING PRECIPITATION GAGE,
N. A. Zykov.
Trans from Trudy Gosudar. Gidrol. INST-TA, No 168, 1969. Soviet Hydrology: Selected Papers, No 4, p 351-356, 1969. 6 p, 2 fig, 2 tab, 2 ref.

Descriptors: *Precipitation gages, *Telemetry, Automation, Instrumentation, Calibrations, Equipment, Gaging stations, Snowfall, Rainfall, Precipitation (Atmospheric).
Identifiers: *Automatic precipitation gages, USSR.

The Valdai Hydrologic Scientific Research Laboratory, USSR, designed a remote recording (totalizing) precipitation gage. This gage is portable and consists of separate receivers for liquid, solid, and mixed precipitation, a pulse detector, remote communication lines, and a battery power supply. The pulse detector is a plastic tipping vessel. It was found that the precipitation measured with the remote-recording precipitation gage differs little from that measured with the sunken rain gage. (Knapp-USGS)
W71-03711

RADIOMETRIC METHODS OF MEASURING THE SOIL MOISTURE CONTENT,
A. M. Dimaksyan, and N. P. Glazkov.
Trans from Trudy Gosudar Gidrolog Inst-Ta, No 168, 1969. Soviet Hydrology: Selected Papers, No 4, p 333-351, 1969. 19 p, 15 fig, 1 tab, 18 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, Reviews, Instrumentation, Calibrations, Moisture content, Nuclear meters, Soil density probes, Soil moisture.
Identifiers: Neutron moisture meters, USSR.

Methods of determining soil moisture are reviewed and new radiometric methods developed in the USSR are described. The State Hydrologic Institute has investigated the neutron method from 1965 to 1968. It was found that moisture measurements with neturon moisture meters and their calibration are best performed through the cadmium ratio. The determination of the soil moisture content reduces to measurements of the ratio count rate of moderated neutrons with a cadmium shield to those without it. This considerably reduces instrument errors and errors associated with the instability of the neutron source, while the measurement range broadens to 100%. The cadmium ratio is a reliable quantitative characteristic of soil moisture. This ratio increases monotonically from 1 to 18 as the moisture content changes from 0 to 100%. With this in view, the Isotope and Radio Electronics Section of the State Hydrologic Institute has developed and constructed instruments for measuring soil moisture at the surface and in the deeper layers. (Knapp-USGS)
W71-03712

CONTROL MEASUREMENTS ON DAMS. RAPID SURVEY METHODS,
Electro-Watt Engineering Services Ltd., Zurich (Switzerland).
For primary bibliographic entry see Field 08A.
W71-03742

SAFETY AND BEHAVIOUR OF CONCRETE DAMS. METHODS OF OBSERVATIONS AND ORGANIZATION,
For primary bibliographic entry see Field 08A.
W71-03743

7C. Evaluation, Processing and Publication

STREAMFLOW GENERATING TECHNIQUES: A COMPARISON OF THEIR ABILITIES TO SIMULATE CRITICAL PERIODS OF DROUGHT,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 02F.
W71-03314

WATERHAMMER ANALYSIS BY THE METHOD OF CHARACTERISTICS,
Bologna Univ. (Italy).
For primary bibliographic entry see Field 08B.
W71-03357

HURRICANE CAMILLE ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
James W. Hudson.
In: Proceedings Water Resources Conference, Mississippi State University, State College, April 14-15, 1970, published by Mississippi State Univ Water Resources Research Institute, p 29-32, 1970. 4 p. OWRR Project A-999-MISS (6).

Descriptors: *Hurricanes, *Floods, *Mississippi, *Mapping, *Surveys, Flood damage, Maps, Data collections, Hydrologic data, Water levels, Publications, Waves (Water).
Identifiers: *Hurricane Camille (1969), U. S. Geological Survey, *Flood mapping.

On November 10, 1969, 12 weeks after Hurricane Camille hit the Mississippi gulf coast the U. S. Geological Survey made public distribution of 14 Hydrologic Atlases showing highwater elevations and the area inundated by the floodwater accompanying the hurricane. These atlases are the culmination of effort that began within 12 hours after the hurricane came ashore in the Bay St. Louis-Pass Christian area. Excluding printing, the cost of the atlases was about $14,000. Behind the Geological Survey's effort to get this information to the public as quickly as possible was the realization that any realistic and effective settlement of insurance claims and the plans for rebuilding in the devastated area would require the delineation of land area flooded. Through close cooperation at all levels, the Survey was able to produce in three months a series of maps that normally requires one to two years to complete. (See also W71-03380). (Knapp-USGS)
W71-03381

DOWSING EXPERIMENTS,
Institute for Industrial Research and Standards, Dublin (Ireland).
R. A. Foulkes.
Nature, Vol 229, No 5281, p 163-168, January 15, 1971. 6 p, 7 fig, 5 tab, 3 ref.

Descriptors: *Dowsing, *Subsurface investigations, *Groundwater, Methodology, Testing, Evaluation.
Identifiers: *Dowsing evaluation (Great Britain), Controlled testing.

The results of several methods of dowsing under controlled experiments organized by the British

Army and Ministry of Defense are presented. The results obtained seem no more reliable than a series of guesses, as indicated in the following experiment. A test of the ability to detect flowing water was arranged with the cooperation of an experienced dowser. A 2-inch polythene pipe carried the water under a lawn and was controlled by a stopcock which the dowser could not see. He was asked to say whether or not the water was flowing in a series of twenty-five trials, the stopcock being on or off in a prearranged random sequence. He used a V shaped rod (rose cuttings) and walked across the line of the pipe to give his verdict. Two sequences were carried out giving fifty results. The water was flowing in twenty-five of these. The dowser was correct in nine cases of water flowing and in sixteen of it not flowing, that is, he was correct in twenty-five out of fifty cases. This is entirely consistent with chance (guessing) and shows no evidence of being able to detect flowing water. (Woodard-USGS)
W71-03389

AN IMPLEMENTATION OF STAGE-FALL-DISCHARGE RELATIONSHIP ON DIGITAL COMPUTERS,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
For primary bibliographic entry see Field 02E.
W71-03393

COMPILATION OF HYDROLOGIC DATA, DEEP CREEK, COLORADO RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Report, 1970. 86 p, 2 fig, 4 tab.

Descriptors: *Rainfall-runoff relationships, *Data collections, *Surface waters, *Hydrologic data, *Flood protection, *Texas, Watershed management, Flood control, Levees, Floods, Streamflow, Rainfall, Runoff, Erosion, Sediment transport, Water quality, Chemical analysis, Gaging stations, Stream gages, Discharge measurements, Flow rates, Peak discharge, Average flow, Reservoirs, Water storage, Storage capacity, Water resources, Reservoir stages.
Identifiers: *Data compilation (Hydrologic), *Deep Creek (Tex).

Runoff and storage data collected during the 1968 water year (October 1967-September 1968) for the 43.9-square-mile area above the stream-gaging station Deep Creek near Mercury, Texas, and the 8.31-square-mile area above the stream-gaging station Dry Prong Deep Creek near Mercury, Texas are presented. The location of floodwater-retarding structures and hydrologic instruments in the area are shown. These 6 structures have a combined capacity of 7,030 acre-feet and regulate floodflow from 25.3 square miles. The weighted-mean rainfall over the Deep Creek study area for the water year was 35.13 inches and 33.05 inches over the Dry Prong Creek study area, or 27% above the long-term average rainfall of 27.74 inches at Brownwood. The ratio of rainfall to runoff ranged from 7.7 to 12.3% for the stations with continuous recording gages. Storm periods were selected for detailed computations. These computations include detailed time breakdown of rainfall and discharge. The water in the reservoirs contained calcium and bicarbonate as the predominant ions. The dissolved solids ranged from 133 mg/liter to 199 mg/liter. (Woodard-USGS)
W71-03398

COMPILATION OF HYDROLOGIC DATA, HONEY CREEK, TRINITY RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Report, 1970. 78 p, 2 fig, 4 tab.

Descriptors: *Rainfall-runoff relationships, *Data collections, *Surface waters, *Hydrologic data, *Flood protection, *Texas, Watershed management, Flood control, Levees, Floods, Streamflow, Rainfall, Runoff, Erosion, Sediment transport, Water quality, Chemical analysis, Gaging stations, Stream gages, Discharge measurements, Flow rates, Peak discharge, Average flow, Reservoirs, Water storage, Storage capacity, Water resources, Reservoir stages.
Identifiers: *Data compilation (Hydrologic), *Honey Creek (Tex).

Rainfall, runoff, and storage data collected during the 1968 water year (October 1967-September 1968) for the 39.0-square-mile area above the stream-gaging station Honey Creek near McKinney, Texas are presented. The location of floodwater-retarding structures and hydrologic instruments in the area are shown. The 12 structures provide capacity for temporary storage of 8,320 acre-feet of flood runoff from 20.9 square miles of the 39.0-square-mile drainage area. The average rainfall was 41.87 inches, or 121% of the 15-year (1953-68) average. The monthly-rainfall totals ranged from 1.04 inches in November to 6.22 inches in September. The mean daily discharge at the stream-gaging station Honey Creek near McKinney was 35.3 cfs, compared with the 17-year average 17.5 cfs. Annual runoff at the stream-gaging station was 25,610 acre-ft, or 12.31 inches. Three storm periods were selected for detailed computations. These computations include a detailed time breakdown of rainfall and discharge, hydrographs, and mass curves. The water in the reservoirs contained calcium and bicarbonate as the predominant ions. The dissolved solids ranged from 148 mg/liter to 209 mg/liter. (Woodard-USGS)
W71-03399

COMPILATION OF HYDROLOGIC DATA, GREEN CREEK, BRAZOS RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Report, 1970. 66 p, 2 fig, 3 tab.

Descriptors: *Rainfall-runoff relationships, *Surface waters, *Data collections, *Hydrologic data, *Flood protection, *Texas, Watershed management, Floods, Levees, Flood control, Streamflow, Runoff, Erosion, Sediment transport, Water resources, Gaging stations, Stream gages, Discharge measurements, Flow rates, Peak discharge, Reservoirs, Water storage, Storage capacity, Reservoir stages.
Identifiers: *Data completation (Rainfall-runoff), Green Creek (Tex).

Rainfall and runoff data collected during the 1968 water year (October 1967-September 1968) for the 46.1-square-mile area above the stream-gaging station Green Creek near Alexander, Texas are presented. The investigation is part of a study to define the various factors of rainfall-runoff relationships before and after floodwater-retarding structures were build. There are eight floodwater-retarding structures with a total combined capacity of 7,500 acre-feet below the flood-spillway crests, that control approximately 50 percent of the drainage area above the streamgaging station. The weighted-mean rainfall over the study area during the 1968 water year was 36.06 inches, or 114 percent of the 1931-60 long-term mean annual rainfall of 31.67 inches at Dublin, Texas. The mean daily discharge at the stream-gaging station Green Creek near Alexander was 14.6 cfs compared with the 10-year average of 5.48 cfs. The annual runoff at the stream-gaging station was 10,610 acre-feet, representing an equivalent depth of 4.32 inches. Six storm periods were selected for detailed computation. These computations include detailed time breakdown of rainfall and discharge, hydrographs, and mass curves. (Woodard-USGS)
W71-03400

MATHEMATICAL SIMULATION HYDROLOGIC EVENTS OF UNGAG WATERSHEDS,
Purdue Univ., Lafayette, Ind. Water Resour Research Center.
For primary bibliographic entry see Field 02A.
W71-03520

INVENTORY INFORMATION ON PUBL LANDS, VOLUME II.
Public Land Law Review Commission, Wash ton, D. C.
For primary bibliographic entry see Field 06E.
W71-03528

PARAMETERIZATION OF OBSERV HYDROGRAPHS,
Vermont Univ., Burlington. Dept. of Civil gineering.
For primary bibliographic entry see Field 02E.
W71-03665

PERSISTENCE OF PRECIPITATION AT 108 TIES IN THE CONTERMINOUS UNIT STATES,
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 02B.
W71-03673

A GENERAL NUMERICAL SOLUTION OF T TWO-DIMENSIONAL DIFFUSION-CONV TION EQUATION BY THE FINITE ELEME METHOD,
California Univ., Davis.
For primary bibliographic entry see Field 05B.
W71-03677

MEAN EVAPORATION OVER CANADA,
Meteorological Service of Canada, Toronto (tario).
For primary bibliographic entry see Field 02D.
W71-03678

ESTIMATING EXPECTED VALUES F MONOTONE SAMPLES,
Geological Survey, Washington, D.C.; Ameri Univ., Washington, D.C.
T. Maddock, III, and D. S. Crosby.
Water Resources Research, Vol 6, No 6, p 17 1745, December 1970. 3 p, 2 tab, 3 ref.

Descriptors: *Statistical methods, *Sampling, C relation analysis, Variability, Data collecti Streamflow forecasting.
Identifiers: *Monotone samples.

New expected value estimates for monotone s ple data can be produced while using the techni to produce a consistent covariance matrix. If correlations between records are large enough, new expected value estimates will be improved mates because the variance of the records wil decreased by the transfer of information from longer records to the shorter records. (Kna USGS)
W71-03689

COMPILATION OF HYDROLOGIC DA CALAVERAS CREEK, SAN ANTONIO RIV BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resou Div.

Geological Survey Report, 1970. 66 p, 2 fig, 4 ta

Descriptors: *Rainfall-runoff relationships, *D collections, *Surface waters, *Hydrologic d *Flood protection, *Texas, Watershed mana ment, Flood control, Levees, Floods, Rain Streamflow, Runoff, Erosion, Sediment transp Water quality, Chemical analysis, Gaging stati Stream gages, Discharge measurement, Flow ra Peak discharge, Reservoirs, Water storage, Sto capacity, Reservoir stages, Water resources.

ıtifiers: *Data compilation (Rainfall-runoff), ıveras Creek (Tex).

ıfall, runoff, and storage data collected during 1968 water year (October 1967-September 8) for the 77.2-square-mile area above the ım-gaging station Calaveras Creek near Elmen-, Texas are presented. The location of flood-r-retarding structures and hydrologic instru-ts in the area are shown. The 9 structures pro-capacity for temporary storage of 12,040 acre-of flood runoff from 37.1 of the 77.2-square-study area. The weighted-mean rainfall was 8 inches, or 134% of the 14-year (1954-68) age. The monthly-rainfall totals ranged from inch in March to 7.99 inches in September. n daily discharge at the stream-gaging station 25.1 cfs compared with the 14-year average of cfs. Annual runoff at the stream gaging station 18,220 acre-feet, or 4.42 inches. Three storm ods were selected for detailed computations. e computations include a detailed time break-ı of rainfall and discharge, hydrographs, and curves. The water in the reservoirs contained um and bicarbonate as the predominant ions. dissolved solids ranged from 52 mg/liter to 165 ter. The water in this basin should be satisfac-for domestic supply, industrial use, and irriga-(Woodard-USGS)
-03704

LITY OF SURFACE WATERS OF THE TED STATES, 1965: PARTS 5 AND 6. HUD- BAY AND UPPER MISSISSIPPI RIVER NS, AND MISSOURI RIVER BASIN.
ogical Survey, Washington, D.C.

sale by Superintendent of Documents, US rnment Printing Office, Wash, DC 20402 - $2.50. Geological Survey Water-Supply r 1963, 1970. 548 p, 1 fig, 32 ref.

riptors: *Water quality, *Surface waters, souri River, *Mississippi River basin, *Water sis, *Data collections, Chemical analysis, ıent transport, Water temperature, Sediment Particle size, Water properties, Water istry.
ifiers: *North-central United States.

ıg the water year ending September 30, 1965, J. S. Geological Survey maintained 181 sta-on 121 streams that drain into the Hudson Upper Mississippi River, and Missouri River the states of Colorado, Illinois, Iowa, Kansas, esota, Missouri, Montana, Nebraska, North ta, South Dakota, Wisconsin and Wyoming. of chemical analyses, suspended sediment, emperature of the surface waters are tabu-Samples were collected daily or monthly at f these locations for chemical-quality studies. les also were collected less frequently at many points. Water temperatures were measured ıuously at 9 stations and daily at 69 stations. ities of suspended sediment are reported for ıtions. Sediment samples were collected one re times daily at most stations, depending on te of flow and change in stage of the stream. le-size distributions of sediments were deter-l at 63 of the stations. (Woodard-USGS)
03707

AMFLOW RECORDS OF THE SNOWY NTAINS REGION, AUSTRALIA TO 1965 - UME 1: GENERAL INFORMATION AND RUMBIDGEE RIVER BASIN.
y Mountains Hydro-Electric Authority, a (Australia).

y Mountains Hydro-Electric Authority Data t, April 1970. 280 p, 8 fig, 2 maps, 2 tab, 100

iptors: *Hydrologic data, *Surface waters, ımflow, *Flow measurement, *Gaging sta- Data collections, Discharge measurement, ge flow, Peak discharge, Stream gages, rology.

Identifiers: *Murrumbidgee River Basin (Australia), *Streamflow basic data, *Australia.

Streamflow data for the Murrumbidgee River Basin, Australia, are presented as volume 1 of three volumes of streamflow records (to 1965) from the Snowy Mountains Region. Streamflow records which could be used for the investigation of the Snowy Mountains scheme began with one station in 1890 and reached a maximum of 122 stations in 1958. This was supplemented by a comprehensive meteorological network to provide detailed information on the variability of runoff, storm rainfalls, snow depth, evaporation and other meteorological elements. The records for each gaging station are presented in three forms: (1) a summary page which contains geographical data, a history of the station, and a summary of its records; (2) Monthly records which contain the runoff volumes of each month of record and the maximum instantaneous discharges observed in each month; and (3) Daily records which contain the daily average discharge. (See also W71-03709 and W71-03710). (Woodard-USGS)
W71-03708

STREAMFLOW RECORDS OF THE SNOWY MOUNTAINS REGION, AUSTRALIA TO 1965 - VOLUME 2: UPPER MURRAY RIVER BASIN.
Snowy Mountains Hydro-Electric Authority, Cooma (Australia).

Snowy Mountains Hydro-Electric Authority Data Report, April 1970. 365 p, 1 map.

Descriptors: *Hydrologic data, *Surface waters, *Streamflow, *Flow measurement, *Gaging stations, Data collections, Discharge measurement, Average flow, Peak discharge, Stream gages, Meteorology.
Identifiers: *Upper Murray River Basin (Australia), *Streamflow basic data, *Australia.

Streamflow data for the Upper Murray River Basin, Australia are presented as volume 2 of three volumes of streamflow records (to 1965) from the Snowy Mountains Region. Streamflow records which could be used for the investigation of the Snowy Mountains scheme began with one station in 1890 and reached a maximum of 122 stations in 1958. This was supplemented by a comprehensive meteorological network to provide detailed information on the variability of runoff, storm rainfalls, snow depth, evaporation and other meteorological elements. The records for each gaging station are presented in three forms: (1) A summary page which contains geographical data, a history of the station, and a summary of its records; (2) Monthly records which contain the runoff volumes of each month of record and the maximum instantaneous discharges observed in each month; and (3) Daily records which contain the daily average discharge. (See also W71-03708). (Woodard-USGS)
W71-03709

STREAMFLOW RECORDS OF THE SNOWY MOUNTAINS REGION, AUSTRALIA TO 1965 - VOLUME 3: SNOWY RIVER BASIN.
Snowy Mountains Hydro-Electric Authority, Cooma (Australia).

Snowy Mountains Hydro-Electric Authority Data Report, April 1970. 322 p, 1 map.

Descriptors: *Hydrologic data, *Surface waters, *Streamflow, *Flow measurement, *Gaging stations, *Australia, Data collection, Discharge measurement, Average flow, Peak discharge, Stream gages, Meteorology.
Identifiers: *Snowy River Basin (Australia), *Streamflow basic data, *Australia.

Streamflow data for the Snowy River Basin, Australia are presented as volume 3 of three volumes of streamflow records (to 1965) from the Snowy Mountains Region. Streamflow records which could be used for the investigation of the Snowy Mountains scheme began with one station in 1890 and reached a maximum of 122 stations in 1958. This was supplemented by a comprehensive meteorological network to provide detailed information on the variability of runoff, storm rainfalls, snow depth, evaporation and other meteorological elements. The records for each gaging station are presented in three forms: (1) A summary page which contains geographical data, a history of the station, and a summary of its records; (2) Monthly records which contain the runoff volumes of each month of record and the maximum instantaneous discharges observed in each month; and (3) Daily records which contain the daily average discharge. (See W71-03708). (Woodard-USGS)
W71-03710

THE GENETIC METHOD OF COMPUTATION OF FLOOD CAUSED BY STORM RAINFALLS IN SMALL CATCHMENT AREAS IN THE ABSENCE OF HYDROLOGICAL DATA,
Wyzsza Szkola Rolnicza, Wroclaw (Poland).
For primary bibliographic entry see Field 02A.
W71-03716

METHOD OF COMPUTING RAINFALL FLOODS CHARACTERISTICS,
Kazakhskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Alma-Ata (USSR).
For primary bibliographic entry see Field 02A.
W71-03717

CONTRIBUTION TO THE METHODOLOGY OF EVALUATION OF MAXIMUM FLOOD FLOW WHEN AVAILABLE DATA ARE INSUFFICIENT (FRENCH),
Office de la Recherche Scientifique et Technique Outre--Mer, Paris (France).
For primary bibliographic entry see Field 02A.
W71-03718

EXPERIMENTAL STUDY OF RAINFALL RUNOFF,
Gidrometeorologicheskii Institut, Odessa (USSR).
For primary bibliographic entry see Field 02A.
W71-03719

RAINFALL FLOOD FORMATION THEORY AND METHODS OF RAINFALL FLOOD COMPUTATION,
Gidrometeorologicheskii Institut, Odessa (USSR).
For primary bibliographic entry see Field 02A.
W71-03720

ESTIMATION OF DESIGN FLOOD DISCHARGES ESPECIALLY FOR RIVER VALLEY PROJECT IN INDIA,
Ministry of Irrigation and Power (India); and Central Water and Power Commission, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03721

ON PRINCIPLES OF ESTIMATION METHODS OF MAXIMUM DISCHARGE,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-03722

DETERMINATION OF MAXIMUM POSSIBLE FLOOD FLOW USING THE UNIT HYDROGRAPH AND THE 'MAXIMUM DURATION INTENSITY' CURVE (FRENCH),
Universite Federale du Cameroun, Yaounde.
For primary bibliographic entry see Field 02E.
W71-03723

SOLUTION OF THE UNSTEADY FLOW EQUATIONS AND ITS USE IN MODELING THE SURFACE RUNOFF PROCESS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-03776

DIGITAL SYSTEMS FOR ON-SITE DATA COLLECTIONS FOR WATER QUALITY ANALYSIS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
For primary bibliographic entry see Field 05A.
W71-03782

08. ENGINEERING WORKS

8A. Structures

NEW MINE SEALING TECHNIQUES FOR WATER POLLUTION ABATEMENT.
Halliburton Co., Duncan, Okla.
For primary bibliographic entry see Field 05G.
W71-03456

EROSION CONTROL ON AIR FORCE BASES,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 02J.
W71-03530

BRIDGE DESIGN CONSIDERING SCOUR AND RISK,
Arizona Univ., Tucson; and Bureau of Public Roads, Washington, D.C.
E. M. Laursen.
Proc Amer Soc Civ Eng, Transp Eng J ASCE, Vol 96, No TE2, p 149-164, May 1970. 16 p, 11 fig, 5 tab, 4 ref, 2 append.

Descriptors: *Bridges, *Piers, Abutments, *Erosion, Design, Rivers, *Bridge design, *Bridge piers, *Scour, Economic feasibility, Maximum probable flood, Foundation failure, Pile foundations, Flood forecasting.

The conclusion of a simple economic analysis is the construction of a bridge foundation so designed that the bridge is safe from scour occurring in the maximum probable flood. Cases of pier scour alone and abutment scour alone are analyzed, assuming reasonable costs of bridge and foundation piles, flood magnitude-frequency relations plotting as straight lines on log-normal paper, the risk of loss during the life of the bridge, and scour prediction relations somewhat verified in the field. (USBR)
W71-03739

CONTROL MEASUREMENTS ON DAMS. RAPID SURVEY METHODS,
Electro-Watt Engineering Services Ltd., Zurich (Switzerland).
R. Sinniger.
Tenth International Congress on Large Dams, Montreal, Can, Vol 3, Quest No 38, p 7-18, June 1970. 12 p, 6 fig.

Descriptors: *Dams, *Instrumentation, Measurement, Damsites, *Concrete, Dams, Equipment, *Earth dams, Control, Settlement, Tiltmeters, *Surveys, Measuring instruments, Dam foundations.

The tendency to build larger dams at sites with complex and often difficult foundation conditions has produced the need for increased expenditure on the surveillance and checking of the completed structure. The measurements obtained, as well as indicating the security of the structure, can be used to determine the behavior of the construction materials. Many measuring instruments are necessary because a single instrument can only record the change in condition of a small portion of the dam. Assessing a large quantity of survey data to judge the behavior of the whole structure is necessary. Only the geodetic control of selected points, and in the case of concrete dams, the use of pendulums, allow the overall behavior of a dam to be checked in a relatively short time. For dams situated at high altitudes, it is not possible to make regular geodetic surveys throughout the whole year, and means were sought for making rapid but accurate partial surveys at certain times of the year. Three such methods dictated by local conditions are discussed, and details are given of the results obtained. (USBR)
W71-03742

SAFETY AND BEHAVIOUR OF CONCRETE DAMS. METHODS OF OBSERVATIONS AND ORGANIZATION,
A. U. Huggenberger.
Tenth International Congress on Large Dams, Montreal, Can, Vol 3, Quest No 38, p 169-178, June 1970. 10 p, 1 tab.

Descriptors: *Dams, Concretes, Safety factors, Design, *Concrete dams, Control, Model tests, Instrumentation, Measurement, Dam foundations, Dam failure, *Safety, Measuring instruments.

The methods of computation, the tests on models, the constant surveillance with adapted measurement instruments and procedures, the strict surveys of concrete, the observations of foundations, abutments, and basin slopes, the appropriate organization of all observations, and the critical judgment of all results enable the safety of a concrete dam to be judged and steps to be taken to avoid serious damage or the complete destruction of the structure, with its disastrous consequences. (USBR)
W71-03743

SOME UNUSUAL ASPECTS OF DAM SAFETY STUDIES IN WESTERN UNITED STATES,
Bechtel Corp., San Francisco, Calif.
K. V. Taylor.
10th International Congress on Large Dams, Montreal, Can, Vol 3, Quest No 38, p 465-487, June 1970. 23 p, 4 fig, 1 ref.

Descriptors: *Dams, *Safety, Earth dams, Concrete dams, Rockfill dams, Dam failure, Inspection, Hazards, Legal aspects, Dam foundations, Seepage, Deterioration, Spillway design flood, *Investigations.
Identifiers: Western United States, Deficiencies, Dam stability, Remedial treatment.

The shifting population distribution toward the west places greater emphasis in this area on the necessity for close inspection and safety investigation of dams, and particularly older dams, many of which were designed and constructed to standards that would be unacceptable now. The principal deficiencies generally are: inadequate spillways; insufficient stability if subjected to major seismic forces; foundation problems caused by extensive faulting, weak bedrocks, and loss of strength of materials when saturated; seepage and drainage problems; and poor quality construction materials, particularly concrete aggregates. Several examples of such conditions are discussed, findings from safety investigations are outlined, and remedial measures required to enhance the safety of the structures are described. The average cost of conducting a safety investigation is estimated to be about $15,000 to $20,000 for engineering, and a similar amount for field exploration. Some legal aspects of safety investigations are mentioned. (USBR)
W71-03753

BASIC CONSIDERATIONS OF WELL DESIGN,
Bureau of Reclamation, Denver, Colo.
T. Ahrens.
Water Well Journal, Vol 24, No 4, 5, 6, 8, p 45-50, 49-51, 47-51, 25-37, Apr, May, June, Aug, 1970. 17 p, 1 tab, 32 ref.

Descriptors: *Water wells, Design, Construct
Aquifers, Wells, Well screens, Well casings, T
ing, *Drilling, Drilling equipment, Grouting, Sh
stress, Corrosion, Groundwater, Economics, E
ciencies.
Identifiers: *Well logging, *Well yield, Gra
packs, Compressive stress, Sulfate-reducing b
teria.

Water well design is concerned with efficient us
the aquifer, reasonable life expectancy, and
operation and maintenance costs in conjunct
with the purpose of the installation and
economics involved. Wells of 150 gpm or mor
unconsolidated aquifers are discussed. Much in
mation presented is equally applicable to sma
wells and to wells in consolidated formations. P
holes, drilling specifications, well hydraulics,
casings, grouting, well screen slot sizes and mat
als, gravel packs, approaches to well developm
and well testing are discussed. The 100% effici
well will never be constructed, but there is
reason to accept wells with a specific capacity o
gpm when the aquifer is capable of 20 gpm.
perience shows that more efficient wells, while h
ing a higher initial cost, are not only less expen
to operate but are less subject to deterioration
failure, and have a longer effective life. (USBR)
W71-03758

FOUNDATION INSTRUMENTATION PLEASANT VALLEY PUMPING PLANT,
Bureau of Reclamation, Denver, Colo. Office
Chief Engineer.
For primary bibliographic entry see Field 08D.
W71-03767

**ROTARIES TO PLAY BIG ROLE IN FUTU
ROCK - DRILLING METHODS,**
Christensen Diamond Products Co., Salt Lake C
Utah.
D. S. Rowley.
Oil and Gas Journal, Vol 68, No 44, p 82-
November 2, 1970. 5 fig, 5 tab, 10 ref.

Descriptors: *Drilling, *Rotary drilling, Drill
equipment, Oil industry.
Identifiers: *Rotary system performance, *Drill
rates, Footage per bit ratios, Drilling cost, De
capacity, Power-transmission capacity, Drilli
rate potential, Tensile stress, Hoop stress, Shear.

Because rotary drilling rates continue to increa
rotary is likely to retain its place of leaders
among drilling methods for the predictable futu
possibly evolving from the conventional jet-rot
drilling system to a rotary-erosion drilling syste
Improvements in rotary performance provid
moving target for the developers of novel drills.
tary-drilling rates will rise as drill pipe with hig
tensile yield strength is applied. The increased yi
strength permits greater combined pipe str
meaning more hydraulic power, more rot
power, and greater hook loads. From developm
work on diamond bits, it is known that competit
and drilling economics both provide compelling
centives in the development of improved to
methods, and materials that can consistently p
vide better field performance at reduced c
Average drilling rates climb; footage per bit
creases; drilling cost per foot decreases. Th
trends are the marks of the moving target, and
tary drilling performance still does not appear to
reaching any real performance plateau. For rot
drilling, it seems that stronger drill pipe will
required and will be used; pump-pressure capac
and power will increase; bit pressure drop
hydraulic power consumption will increase s
stantially; and rotary power consumption capac
of bits and their coupling efficiency to the r
must increase. (Campbell-NWWA)
W71-03830

FISHING IS MORE ART THAN SCIENCE,
Forest Oil Corp., Midland, Tex.
For primary bibliographic entry see Field 04B.
W71-03832

'S TO MILLING, WASHOVER OPERA-NS,
al Oil and Gas Co., Midland, Tex.
primary bibliographic entry see Field 04B.
-03833

IGN AND RATING OF WELLS AND WELL DS,
igan State Geological Survey, Lansing. Dept. nservation.
rimary bibliographic entry see Field 04B.
-03836

DUCTION ANALYSIS OF ARTESIAN LS,
ıe Univ., Lafayette, Ind.
rimary bibliographic entry see Field 04B.
03837

ELOPMENT OF REVERSE-ROTARY LS,
er-Weiss Co., Denver, Colo; and Lauman .), Bethpage, N.Y.
Gossett, and H. Lauman.
r Well Journal, Vol 13, No 3, p 48-49, March 3 fig.

iptors: *Drilling, *Rotary drilling, Water Drilling equipment, Irrigation wells, ınge wells, Municipal wells.
fiers: *Reverse-rotary drilling, *High produc- application, *Completion, Major population rs, Gravel packing.

letion methods used in reverse-rotary wells fferent only in that they must be consistent he requirements of a large-diameter installa- As in any other type of wells, the method used mpleting depends upon formation charac- cs, water level conditions, and the end use of ell. The cleaning and development require- of the reverse-rotary well are ordinarily al since it is seldom necessary to use mud ad- s for drilling. The use of reverse-rotary in con- ion of wells for municipal and commercial ses is prevalent in major population centers ghout the U.S. Irrigation wells drilled by e circulation are in wide use in Midwestern d States. The terminal moraine offers many ems to the well driller because of unstratified re of clays, sands and gravel. The use of e-rotary drilling equipment solves many of problems. (Campbell-NWWA)
03844

LOPMENT OF WELLS WITH CABLE S,
us-Erie Co., South Milwaukee, Wis.
Gordon.
Well Journal, Vol 13, No 2, p 36-39, ary 1959. 4 fig, 2 tab.

ptors: *Drilling, *Water wells, Drilling nent.
iers: *Cable tool drilling, Rock wells, Gravel *Development methods, Backwash comple- Surging, Screened wells, Compressed air pment.

ble tool method lends itself to development lures with more chances of success than by her method of similar expense. Cable tool normally does not include the use of mud or es and aquifers are less likely to be made im- us to any degree. A cable tool well finished in ck is quite often improved by simply pump- is cleans out the fines and cuttings which ave become lodged in the formation by action. Some rocks wells can be further ped by the use of a surge pressure block. A n be developed by two main methods-surg- compressed air. These are two types of surge rs with variations ranging from weighted with ring washers to rope-wound drill stems. eneral methods for developing wells with essed air are (1) backwashing and (2) open well surging. The principle of backwashing is to force water out of the well through the screen and into the formation by compressed airs. Open well surging with compressed air is capable of more vigorous application than the backwashing method. (Campbell-NWWA)
W71-03845

REVERT CUTS COSTS AND MAKES BETTER WELLS,
Universal Oil Products Co., St. Paul, Minn. Johnson Div.
F. F. Zdenek.
UOP Johnson Drillers Journal, Vol 41, No 6, p 1-3, November-December 1969. 3 fig, 2 ref.

Descriptors: *Drilling fluids, *Water wells, Rotary drilling.
Identifiers: *Revert, *Bentonite mud, Drilling efficiency.

Revert is a food-grade, organic material which makes a bright blue drilling fluid when mixed with water at a ratio of about 6 pounds per 100 gallons. After a certain period of time, the fluid reverts to the viscosity of water through enzymatic action. Being a low solid, self-destroying fluid, revert does not contaminate water-bearing sands with clay particles and can be removed completely from the well during development. When it is used as a drilling fluid, water wells have significantly higher yields than those drilled with conventional drilling mud. It reduces friction in the mud-circulating system. This, together with other characteristics, can mean cost savings in the overall drilling operation. Revert makes it possible to drill more holes faster, because it can reduce friction losses in the circulating system by as much as 40%. Penetration rates are increased, so larger, deeper holes can be drilled faster and cheaper. A few case histories are described. (Campbell-NWWA)
W71-03846

REVERSE ROTARY WELL CONSTRUCTION,
Illinois State Water Survey, Urbana.
Robert T. Sasman.
Public Works, Vol 88, No 4, p 117-118, April 1957.

Descriptors: *Drilling, *Rotary drilling, Water wells, Drilling equipment, Municipal wells, Illinois.
Identifiers: *Reverse-rotary drilling, High water productivity applications, Large-diameter wells, Gravel packing.

The construction, drilling and testing of a large diameter water well in Urbana, Illinois is discussed. Well was drilled using reverse hydraulic rotary method which requires a large volume of water to circulate between the supply pit and down the hole outside the drill stem. Water and drill cuttings are returned to surface by suction through drill stem which is one of the early successful attempts in using the reverse circulation method. (Campbell-NWWA)
W71-03847

CEMENTING WATER WELLS,
Halliburton Oil Well Cement Co., Houston, Tex.
B. D. Brown.
Public Works, Vol 90, No 9, p 99-100, September 1959. 2 fig.

Descriptors: *Cements, *Water wells, Casings, Construction equipment, Texas, Oil industry.
Identifiers: *Cementing water wells, *Isolation of producing zones, Yield stimulation, Protection of casing, Bentonite.

This article discusses the techniques and materials which will aid in obtaining maximum control of isolating the producing zones. Isolation is very desirable to protect water-bearing formations from contamination of less desirable strata or from the surface. The use of cementitious materials will provide the most effective means of obtaining this isolation, will permit techniques of stimulations requiring hydraulic pressure and fluids, and will help to protect casing against corrosive waters. The types of materials used to cement casings are many, all of which permit dry blending of several additives to meet specific well conditions. A new tool developed for the petroleum industry incorporates feastures which are compatible for water well completions. In operation of this tool, a special plug is dropped from the surface and, through application of pump pressure, sets the sealing element and opens circulating ports. Cement material is mixed and pumped into the casing, through the circulating ports and above the sealing element. The top cementing plug seats on a special sleeve and through the application of pressure closes the circulating ports. Continued application of pressure shears the pins permitting plugs and sleeve to be pumped out of tool which thereby eliminates a drilling-out operation. (Campbell-NWWA)
W71-03848

8B. Hydraulics

ASYMPTOTIC NONLINEAR WAVE MOTION OF A VISCOUS FLUID IN AN INCLINED CHANNEL OF ARBITRARY CROSS SECTION,
Wisconsin Univ., Madison. Mathematics Research Center.
M. C. Shen, and S. M. Shih.
Available from NTIS as AD-715 958, $3.00 in paper copy, $0.95 in microfiche. MRC Summary Technical Report No 1047, February 1970. 30 p, 2 fig, 18 ref. OWRR Project A-037-WIS (1); and U S Army, Contract No DA-31-124-ARO-D-462.

Descriptors: *Wave action (Water), *Channe FLOW, *Surface tension, *Dimensional analysis, *Viscosity, Flow.
Identifiers: Tractable asymptotic theory, Viscous fluid, Linear elliptic, Three dimensional, Multiple-parameter.

A tractable asymptotic theory is achieved for the study of three-dimensional nonlinear wave motion of an incompressible, viscous fluid with surface tension in an inclined channel of arbitrary cross section. The method developed here is based upon a multiple-parameter singular perturbation scheme within the framework of long-wave approximation. The nonlinear problem is reduced to a sequence of linear elliptic mixed boundary-value problems, which can be solved by means of standard methods. Their solutions are then used to determine the wave speed and evolution equations governing the nonlinear wave motion. The results obtained give a quantitative description of a three-dimensional bore structure in an inclined channel of arbitrary cross section, and critical Reynolds number is also defined as a criterion for the instability of the wave motion.
W71-03309

A STATISTICAL MODEL TO PREDICT THE TRANSIT CAPACITY OF SEAL-LEVEL CANALS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
B. G. Stinson, J. W. Brown, and J. Harrison.
Sponsored by Atlantic-Pacific Interoceanic Canal Study Commission. U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper H-69-12, December 1969. 19 p, 3 fig, 2 tab, 19 ref.

Descriptors: *Mathematical models, *Canals, Navigation, Ships.
Identifiers: *Statistical models, *Sea-level canals, *Transit capacities (Waterways).

The derivation and application of a statistical model in the form of an algebraic equation which predicts yearly capacities of sea-level canals are presented in this report. The equation considers only the following significant variables: canal geometry, ship mix, ship stopping distances, length

and number of convoys, desired maximum waiting time, and overall canal efficiency (to predict transiting at less than maximum capacity). A simple algebraic representation is particularly useful because it can be used for preliminary canal transit studies without the need for either sophisticated mathematics or digital computer facilities. After narrowing the number of technically and economically feasible alternatives with the canal transit equation, the remaining alternatives can be studies in more detail by other means. Because of time limitations on the study, the canal transit equation has not been tested against either known solutions or solutions given by the digital computer simulation derived as part of this study and described in U. S. Army Engineer Waterways Experiment Station Miscellaneous Paper H-69-10. (Stinson-WES)
W71-03319

BOUNDARY EFFECTS OF GRADED ROUGHNESS ELEMENTS IN TWO-DIMENSIONAL FLOW IN OPEN CHANNELS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
B. J. Brown.
Sponsored by Assistant Secretary of the Army (R and D), Department of the Army. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper H-70-6, May 1970. 5 p, 1 fig, 2 pl, 22 tab.

Descriptors: *Open channel flow, *Roughness (Hydraulic), Riprap, *Bank protection.
Identifiers: *Boundary effects, *Two-dimensional flow.

Tests were made on crushed graded limestone simulating riprap protection in two-dimensional flow in a 48-ft-long tilting flume. Three stone gradations involving different stone size ranges were tested. The results indicate that the root-mean-square of the surface protrusions is a suitable parameter for defining surface effects of densely spaced graded roughness elements such as quarry riprap. The average velocity can be expressed by an equation. (Brown-WES)
W71-03323

TIDAL PRISM MEASUREMENTS AT MOUTH OF COLUMBIA RIVER; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
F. A. Herrmann.
Sponsored by U. S. Army Engineer District, Portland, Oregon. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper H-70-3, June 1970. 4 p, 36 plates.

Descriptors: *Estuaries, *Tides, *Columbia River, *Hydraulic models, Oregon.
Identifiers: *Tidal prisms.

Measurements of tidal prism at the mouth of the Columbia River were made in the existing model of the Columbia River estuary. The measurements were made for mean and spring tide conditions and involved integration of systematic measurements of cross-sectional area, current velocity, and tidal elevations. (Herrmann-WES)
W71-03324

INSIGHTS GAINED FROM RIVER SEDIMENTATION MODELS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 02J.
W71-03325

EFFECTS OF PROPOSED ELIZABETH RIVER DIKE ON TIDES, CURRENTS, SALINITIES AND SHOALING; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. A. Boland, and W. H. Bobb.
Sponsored by U. S. Army Engineer District, Norfolk, and Naval Facilities Engineering Command, Norfolk. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper H-69-13, December 1969. 5 p, 4 tab, 13 photo, 17 plates.

Descriptors: *Dikes, *Tides, *Currents (Water), *Salinity, *Shoals, *Hydraulic models.
Identifiers: *Elizabeth River.

Existing comprehensive fixed-bed model of James River was used to determine effects of the proposed Elizabeth River dike. Test results consist of measurements of tide heights, current velocities, salinities, and shoaling quantities. From these data it was concluded that the proposed dike had little effect on tides, currents, or salinities in the problem area. In the model, the major source of sediment moving to and depositing in the Elizabeth River channel was found to be the shallow-water area between the Craney Island disposal area and the Newport News Channel. If this area does, in fact, constitute the major source of Elizabeth River channel shoaling in the prototype, the annual shoaling rate in the channel will be greatly reduced by construction of the dike; and the shoaling in the slips will be increased slightly. It is recommended that consideration be given to radioisotope or other tracer techniques to determine the source of shoaling in the Elizabeth River channel, provided an analysis of benefits and costs indicates that construction of the dike would be economically feasible. (Boland-WES)
W71-03326

WATERHAMMER ANALYSIS BY THE METHOD OF CHARACTERISTICS,
Bologna Univ. (Italy).
G. Evangelisti.
L'Energ Elettrica, Vol 46, No 10, 11, 12, p 673-692, 759-771, 839-858, Oct/Nov/Dec 1969. 53 p, 64 fig, 155 ref.

Descriptors: *Water hammer, Digital computers, Fluid mechanics, Fluid flow, *Mathematical models, Fluid friction, Pipelines, Surge tanks, Flow diagrams, Computer programs, Bibliographies, Technology, Calculations, Hydraulics, Foreign research.
Identifiers: *Method of characteristics, Italy, Boundary conditions, Water column separation, Acceleration (Mechanical).

Water hammer problems are analyzed by using the method of characteristics in the theoretical investigation and in the numerical computation. Disturbed flow is considered, allowing for compressibility and fluid friction; pipes are considered as having a section with elastic characteristics. Hydraulic and mechanical systems placed at the ends of each pipe are considered as extremity conditions. Mathematical models are established and solved by computer programs that divide the numerical procedure into elementary subprograms. A method is given for using the stored subprograms in various combinations for solving specific problems. A review of actual cases illustrates the proposed technques and introduces some new formulation criteria. An extensive bibliography of 155 references on water hammer technology is given. (USBR)
W71-03357

HEAD LOSSES IN WYES AND MANIFOLDS,
British Columbia Univ., Vancouver.
E. Ruus.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY3, p 593-608, Mar 1970. 16 p, 13 fig, 1 tab, 10 ref, 2 append.

Descriptors: *Head loss, Hydraulic models, Hydraulics, Pipe bends, *Pipe flow, Pipelines, Instrumentation, Manometers, Pressure head, Tie rods, Discharges, Foreign research, Test procedures, Analysis, Discharge measurement.
Identifiers: Test results, *Manifolds, *Wye branches, Bifurcations, Canada, Foreign testing, Accuracy, Velocity head.

Head loss coefficients are determined exper
tally for symmetrical and unsymmetrical
through 9 symmetrical conical and spherica
and manifolds. The diameters of the mai
branch pipes are 5-1/4 in. and 3-3/4 in. The
of bifurcation varies from 45 deg to 90 deg
conical wyes and manifolds are tested wit
without tie rods of 3/16, 3/8, 9/16, and 3/4 i
placed in turn at the center of the wye. The c
ters of the spheres of spherical wyes are 5.
and 7.50 in. Head loss depends on the an
bifurcation, the diameter of the tie rod
sphere, and the ratio between discharges
branch and main pipes. For symmetrical flo
ditions, the head losses caused by wy
manifolds with an angle of bifurcation not o
deg are less than 10% of the velocity head
main pipe. Tie rods increase head losses and
be avoided. (USBR)
W71-03359

GEOMETRIC STABILITY ANALYSIS O ALLUVIAL RIVER,
Corps of Engineers, Vicksburg, Miss. Potam
Section.
Brien R. Winkley, and Lamont G. Robbins.
In: Proceedings Water Resources Conference
sissippi State University, State College, Ap
15, 1970, published by Mississippi State
Water Resources Research Institute, p 7
1970. 28 p, 2 tab, 12 chart, 9 ref. OWRR P
A-999-MISS (6).

Descriptors: *Mississippi River, *Cl
morphology, *Scour, *Sediment transport, *
nel improvement, River training, Flood contr
luvial channels, Hydraulics, Channel e
Channel flow, Distribution patterns, R
Shape.
Identifiers: *Fluvial hydraulics.

Geometric analysis of the Mississippi River
that there is an optimum depth to which any
will scour and that there is a specific spacing
and pools that is dependent on the discharge
sequently, in any channel improvement proje
general alignment of the natural channel m
studied in order to determine the geometri
tionships that need to be conserved. The bar
be locked into natural deposition areas, the
must be controlled, and there must be s
transitions from pools to crossings and ba
pools in order for the improved channel to o
properly. (See also W71-03380). (Knapp-US
W71-03383

CONTROL OF SCOUR AT HYDRA STRUCTURES,
Army Engineer Waterways Experiment S
Vicksburg, Miss. Hydraulics Div.
Thomas E. Murphy.
In: Proceedings Water Resources Conference
sissippi State University, State College, Ap
15, 1970, published by Mississippi State
Water Resources Research Institute, p 10
1970. 13 p, 9 fig. OWRR Project A-999-MISS

Descriptors: *Drops (Structures), *Erosion
trol, *Outlets, *Stilling basins, *Energy dissip
Control sturctures, Turbulence, Turbulent
Scour, Alluvial channels.
Identifiers: *Scour control.

Tests conducted at the U. S. Army Corps
gineers Waterways Experiment Station d
strate the advantages in providing for or pr
ing a 'scour hole' in which flow can expand a
sipate its excess energy in turbulence rather t
a direct attack on the channel bottom and
Even a relatively small amount of expa
preferably both vertically and horizontall
greatly reduce the severity of the attack
channel boundaries. This makes it possible
bilize the channel with rock of an economic
and provides additional factors of safety
riprap failure and costly maintenance. (Se
W71-03380). (Knapp-USGS)
W71-03384

DARCY FLOW IN THE VICINITY OF
LS,
South Wales Univ., Kensington (Australia).
l of Civil Engineering.
imary bibliographic entry see Field 02F.
03403

RY AND APPRAISAL OF HYDRAULIC
ITIONS IN WELLS,
Conservation and Irrigation Commission
alia).
orbes.
ceedings of Groundwater Symposium, New
Wales University, Manly Vale, Australia,
28-29, 1969: New South Wales University
Research Laboratory Report No 113, Paper
28-49, April 1970. 22 p, 14 fig, 9 ref, 2 ap-

ptors: *Groundwater movement, *Water
*Withdrawal, *Dupuit-Forchheimer theory,
down, Well screens, Pumping, Water yield,
law, Permeability.
iers: *Aquifer testing, *Well testing, Well ef-
y.

e of the standard well tests is discussed in
n to drawdown prediction, determining the
f development, and studying suitability of
and construction. The presence of a non-
oss does not mean that a considerable linear
ss may not also be present. If linear well loss
pared with the aquifer loss between the well
and the screen the effect of clogging can be
observed. Part of enlightened well opera-
ould include periodical step drawdown tests
t duration in order to assess deterioration of
lic condition. Well testing should also be
ed for drawdown prediction and assessment
efficiency. (See also W71-03401) (Knapp-

3404

NAL HYDRAULICS OF THERMAL
ARGE DIFFUSERS, A DISCUSSION,
Dresser and McKee, Boston, Mass.
nary bibliographic entry see Field 05D.
3461

LENT DIFFUSION AND ENTRAIN-
IN TWO-LAYER FLOW, A DISCUSSION,
Rico Univ., Mayaguez. Dept. of Civil En-
g.
ih Kuo.
of the Waterways and Harbors Division,
lings of the ASCE, Vol 96, No WW4, Nov
867-868. 1 fig, 1 ref.

tors: *Turbulent diffusion, *Density
ation, Temperature Gradient, Turbulence,
irs, Mixing.
ers: *Entrainment in two-layer flow,
tification, Molecular entrainment.

dy was conducted primarily to seek new
s for the destratification of a reservoir with
cline in order to prevent the deterioration of
om waters. In the paper a similar type of
xplaining the mechanism of turbulent diffu-
d entrainment was proposed. One conclu-
hat this model can be used for laboratory
tions without spending a long time on the
pe observations. Then a relation between
otype and the model may be established to
the desired field date. The external flow
circulated by means of pumping may pass
a honeycomb or a porous wall, generates
flow fields in the two regions, and in-
s a disturbance with its accompanying ener-
. Two independent mixing processes are:
d pumped from one region to another and
; and (2) possible entrainment occurring
he density interface. It is said that the
nethod can be augmented by creating addi-
rbulent agitation at the interface, other-
lecular entrainment would prevail. (Her-
nderbilt)
462

HEATED SURFACE JET DISCHARGED INTO A FLOWING AMBIENT STREAM,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W71-03478

SEDIMENT TRANSPORTATION MECHANICS: F. HYDRAULIC RELATIONS FOR ALLUVIAL STREAMS.
For primary bibliographic entry see Field 02J.
W71-03667

SEDIMENT TRANSPORTATION MECHANICS: Q. GENETIC CLASSIFICATION OF VALLEY SEDIMENT DEPOSITS.
For primary bibliographic entry see Field 02J.
W71-03668

EFFECT OF CHANNEL SHAPE ON GRADUALLY VARIED FLOW PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
Nagar S. Lakshmana Rao, and Kalambur Sridharan.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY1, Paper 7798, p 55-64, January 1971. 10 p, 6 fig, 4 ref, append.

Descriptors: *Open channel flow, *Channel morphology, *Flow profiles, Froude number, Flow rates, Regime, Canals, Alluvial channels, Stage-discharge relations.
Identifiers: Gradually varied flow.

Gradually varied flow profiles were analyzed with Froude number as a reference parameter. Generalized nondimensional varied flow profiles of the M and S types were computed for 56 channel shapes covering a wide range of rectangular, trapezoidal, triangular and parabolic channels. The computation results are presented in a summarized form taking the nondimensional profile length as the characteristic parameter. The effect of channel shape and Froude number on the varied flow profiles were studied. The figures presented can be used to obtain a rapid estimation of profile lengths for the channel shapes considered. (Knapp-USGS)
W71-03669

HYDRAULIC JUMP WITHIN GRADUALLY EXPANDING CHANNEL,
Asian Inst. of Technology, Bangkok (Thailand). Dept. of Hydraulic Engineering, and Mindanao Development Authority (Philippines).
Anat Arbhabhirama, and Alejandro U. Abella.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY1, Paper 7831, p 31-42, January 1971. 12 p, 9 fig, 4 ref, append.

Descriptors: *Hydraulic Jump, *Stilling basins, *Hydraulic models, Open channel flow, Energy dissipation, Model studies, Mathematical models, Critical flow, Supercritical flow, Uniform flow.
Identifiers: *Hydraulic jump (Expanding channel).

Expanding channel jump is considered to behave as a section of a circular jump. Equations describing the characteristics of the expanding channel jump are derived, using observations conducted with 6 different angles of divergence. The experimental results showed a close agreement with theoretical solutions. The general equation developed for the jump, with proper evaluation of the side pressure force effect, describes the phenomenon regardless of the angle of divergence. An empirical expression for approximating the location of the jump within the transition was also developed. (Knapp-USGS)
W71-03670

A GENERAL NUMERICAL SOLUTION OF THE TWO-DIMENSIONAL DIFFUSION-CONVECTION EQUATION BY THE FINITE ELEMENT METHOD,
California Univ., Davis.
For primary bibliographic entry see Field 05B.
W71-03677

NUMERICAL SOLUTION TO THE CONVECTIVE DIFFUSION EQUATION,
Battelle-Northwest, Richland, Wash.
For primary bibliographic entry see Field 05B.
W71-03690

SOLUTION OF STEADY FLOW IN OPEN CHANNELS BY GRAPHS,
Tarbela Dam Project, Hazara (West Pakistan).
Horace A. Johnson.
Civil Engineering, Vol 40, No 12, p 46-47, December 1970. 2 p, 2 fig.

Descriptors: *Open channel flow, *Steady flow, *Stage-discharge relations, Channel morphology, Water measurement, Uniform flow, Mannings equation, Discharge measurement, Hydraulic radius, Roughness (Hydraulic).
Identifiers: *Trapezoidal open channels.

A method for computing uniform flow in trapezoidal channels through the use of two graphs is presented. The first graph gives the relationships among slope, flow, area, and velocity, for a section whose hydraulic radius equals 0.328 of the sq root of cross-sectional area. The value of the coefficient of friction in Manning's formula is also included among the relationships. The second graph gives the effect of change in channel side slope, bottom width, and depth of water. This graph also shows directly the most economic channel sections. (Knapp-USGS)
W71-03702

ESTIMATE OF TURBULENCE AND HYDRAULIC RESISTANCES DURING WAVE MOTION IN BODIES OF WATER,
For primary bibliographic entry see Field 02E.
W71-03713

SIMULATION OF HORIZONTAL TURBULENT DIFFUSION OF PARTICLES UNDER WAVES,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W71-03714

THE EFFECT OF RAINFALL ON THE MECHANICS OF STEADY SPATIALLY VARIED SHEET FLOW ON A HYDRAULICALLY SMOOTH BOUNDARY,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03727

HEAD LOSSES IN UNLINED ROCK TUNNELS,
Royal Inst. of Tech., Stockholm (Sweden).
E. Reinius.
Water Power, Vol 22, No 7/8, p 246-252, July/Aug 1970. 7 p, 16 fig, 5 tab, 18 ref.

Descriptors: *Tunnels, Tunnel design, *Tunnel hydraulics, *Head loss, Tunneling, Tunnel construction, *Roughness (Hydraulic), Bibliographies, Roughness coefficient, Test facilities, Friction, Laboratory tests, Rock mechanics, Discharges, Foreign research, Velocity, Fluid mechanics, Flow resistance, Hydraulics.
Identifiers: Tunnel supports, Foreign testing, Sweden, Test results, Friction factors, Friction coefficient (Hyd).

An investigation into the effects of roughness, driving direction, and reinforced portals on head loss in unlined hydraulic rock tunnels is described. The roughness of an unlined rock tunnel is influenced by: (1) the rock structure, (2) the advancing direction when excavating the tunnel, (3) the spacing of boreholes around the contour line of the tunnel, and (4) the blasting method. A test flume was used to study the influence of the orientation of the serrations and the wall surface roughness on the

friction factor. The orientation of the serrations had a pronounced influence on the frictional resistance to flow. A tunnel excavated with the advancing direction against that of the flow has a lower head loss than a tunnel excavated in the flow direction. The influence of local reinforcing members at weak parts of the tunnel on resistance to flow was investigated. Three types of arch ribs were tested; an arch rib with bevelled corners gave a much smaller resistance to flow than an arch rib with sharp corners. For a certain cross-sectional area of the rib, a low, wide cross section gives less head loss than a high, narrow section. Has 18 references. (USBR)
W71-03735

ENERGY DISSIPATION USING AIR INJECTION,
Nottingham Univ. (England).
N. Hay.
Paper Hydraul Div Spec Conf, Univ Minn, Minneapolis, Aug 1970. 16 p, 7 fig, 10 ref, 2 append.

Descriptors: Kinetic energy, Energy, *Energy dissipation, Hydraulics, Erosion, Hydraulic jump, *Fluid mechanics, *Aeration, Turbulence, Scour, Air entrainment, High pressure, Nappe, Foreign research, Model tests, *Flow, *Spillways, Air-water interfaces.
Identifiers: Great Britain.

A method of energy dissipation suitable for spillways in which air is introduced at the interface between the structure and the water nappe in the upper reaches of the structure is described and evaluated. Air induces turbulence in the stream, and kinetic energy is dissipated as it is generated. Literature on aerated flows supports the claims made for this method. Results of exploratory tests on a model spillway with air injection confirm that air injection reduces the energy at the foot of the spillway. A mean reduction nearing 50% was obtained in the model at an air concentration of 28%. The effect of air injection on the hydraulic jump at the foot of the spillway was beneficial because the jump was more stable and nearer to the foot of the spillway. (USBR)
W71-03737

SOLUTION OF THE UNSTEADY FLOW EQUATIONS AND ITS USE IN MODELING THE SURFACE RUNOFF PROCESS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-03776

8C. Hydraulic Machinery

INCREASING THE ACCURACY OF DESIGN CALCULATIONS FOR CRITICAL SPEEDS OF THE ROTOR OF A HYDRAULIC UNIT BY THE METHOD OF INITIAL PARAMETERS,
Bureau of Reclamation, Denver, Colo.
A. U. Bugov.
Translation of: Energomashinostrvenie No 11, p 6-10, 1964. Available from NTIS as PB-193 623T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 692, August 1967. 18 p, 3 tab, 7 ref.

Descriptors: Rotation, Rotating components, Turbine runners, Rigidity, *Vibrations, Mathematical analysis, Moments of inertia, *Critical speed, Shafts, Machinery, Generators, Hydraulic turbines, Structural analysis, Structural behavior, Machines, Differential equations, Elasticity, Flexible foundations, Boundary values, Eccentric loading, Stress.
Identifiers: Stators, *Rotors, USSR, *Machine design, Gyroscopic effects, Initial parameters method.

A method is presented for calculating critical speeds and constrained vibrations of the rotor of a hydraulic unit, considering the important structural parameters: elasticity of the support, gyroscopic effect of mass settlement, and variable rigidity of the rotor along its length. Design calculations for modern powerful hydraulic units, such as at Krasnoiarsk Powerplant in the USSR, should include these factors. The rotor is considered as a vibrating string with 2 or 3 seated masses along it, dividing it into several parts. A. N. Krylov's method of initial parameters can be used for calculating shafts on an elastic foundation and critical speeds of rotors. The method is equivalent to substituting a system of differential equations with constant coeffecients for different rotor parts for a differential equation with variable coefficients. The solution is written with the help of functions formed by normal fundamental systems. The initial parameters used values for weights, moments of inertia of the mass, and flexibility of the support. Examples of solutions are given and compared with results of calculations for critical speeds without considering these factors. If electronic computers are used, the functions can be calculated according to factorization formulas, containing 3 to 4 factors.
W71-03526

THE ELECTRIC RESEARCH COUNCIL'S UNDERGROUND TRANSMISSION R AND D PROGRAM,
Edison Electric Inst., New York.
G. E. Watkins.
Paper 2nd Annual Meeting, Int Elec Res Exch, Cannes, France, Sept 1970. 14 p, 1 tab.

Descriptors: Research and development, Electrical industries, Electric power, *Extra high voltage, Electric cables, *Transmission (Electrical), Technology, Capacitance, Electric insulation, Costs, Experimental data, Dielectrics, Cooling, Cryogenics, Superconductivity, Supercooling.
Identifiers: *High voltage, Electric Research Council, Pipe-type cables, Oil-filled cables, *Underground transmission lines.

The problems and costs of putting high-voltage transmission systems underground are very different from those of the routine underground distribution of energy at low voltages. The extensive underground transmission R and D program of the Electric Research Council (ERC) seeks to perfect existing cable technology and to develop new ways of conveying large blocks of electric energy underground. Projects in progress are directed at the immediate demand for expanded underground operation. The longer-term projects, with potential for greater overall return, are designed to resolve the difficult and exacting problems associated with providing tomorrow's huge amounts of electrical power to our cities. The day of simple, reliable, and economic transmission of great blocks of power for long distances underground is still in the future. Under the program of the ERC, all segments of the electric utility industry in the U.S. are supporting the research and development efforts necessary to ensure that proper technology will be available for satisfying the vast future demands for underground power transmission. (USBR)
W71-03733

ELECTRIC GENERATING PROSPECTS FOR NUCLEAR POWER,
Massachusetts Inst. of Tech., Cambridge.
M. Benedict.
Inst Elec Electron Eng Spectrum, Vol 7, No 7, p 24-30, July 1970. 7 p, 6 fig, 5 tab.

Descriptors: *Electric power production, *Nuclear powerplants, Costs, Nuclear reactors, Thermal pollution, Efficiencies, Economics, Sodium, Electric powerplants, Electric power costs, Electric power.
Identifiers: *Nuclear power, Uranium, Plutonium, Fuel costs, *Breeder reactors, Boiling-water reactors, Liquid-metal-cooled reactor.

In many sections of the U S thermal nuclear reactors compete with coal-fired electric plants, but if nuclear plants are to achieve full potential, developing an economical fast breeder reactor will be necessary. Most nuclear powerplants in the U S are of the light-water variety. In many parts o U S the plants are competitive with plants bu coal, but the electricity generated will be costly in the future as uranium supplies depleted. A promising possible answer to the problem is the fast-neutron reactor, produces more fuel than it consumes. Such a should be a more efficient generator of electr producing less thermal pollution than a water- tor plant. Breeding the fuel to make the fast tors possible takes time; until more is known the performance of such reactors, final judg about the economic feasibility must continue withheld. (USBR)
W71-03759

DRILLING-MUD LUBRICITY,
National Lead Co., Houston, Tex. Baroid Div.
For primary bibliographic entry see Field 04B
W71-03831

CONSIDER LOST CIRCULATION IN V PLANNING, RIG SELECTION,
Mobil Oil Corp., New Orleans, La.
For primary bibliographic entry see Field 04B
W71-03834

DIAMOND DRILLABILITY STUDIES,
Bureau of Mines, Minneapolis, Minn. Twin Mining Research Center.
William E. Bruce.
Mines Magazine, Vol 58, No 3, p 26-27, 1968.

Descriptors: *Drilling, Core drilling, mechanics, Mining, Oil industry, Drilling ment.
Identifiers: *Rock drillability, *Diamond d Compressive rock strength, Experimental dri ty curves, Theoretical drillability curves, G water industry.

Drilling studies conducted by the Bureau of were aimed at establishing indices for pre rock drillability based on the applied forces, the physical properties of the rock, sociated parameters. The need for such ind great. Drilling has always represented an imp cost in the mining, petroleum and groundwa dustries. Diamond drilling experiments were in the field to test the validity of earlier labo findings. Field experiments were set up to data on a larger number and variety of roc those drilled in the laboratory and to determ applicability of the laboratory results to actu drilling situations. Previous laboratory drilli on nine different rocks suggested that comp strength of rock could be a parameter for de ing drillability. The results come from exper involving 26 rock formations drilled in th with a commercial diamond drill as well as w similar to those used in the laboratory test. (bell-NWWA)
W71-03842

8D. Soil Mechanics

PRELIMINARY FINITE ELEMENT ANA ATCHAFALAYA BASIN PROTE LEVEES TEST SECTION 3,
Army Engineer Waterways Experiment Vicksburg, Miss.
J. B. Palmerton.
Prepared for the President, Mississippi Rive mission. U.S. Army Engineer Waterways ment Station, Vicksburg, Mississippi, Misc ous Paper S-69-53, December 1969. 26 p, 1

Descriptors: *Levees, *Foundation investi *Clays, Soil properties, Mississippi.
Identifiers: *Atchafalaya River Basin, Fin ment method.

liminary finite element analysis was made for ee test section constructed within the falaya Basin Protection Levee system. The is was performed to explore the applicability e finite element method for studying the ior of levees placed on weak foundation als. Three types of finite element analyses scribed. The first, the secant method, ap- nates the stress-strain curves with elastic and envelopes. The second, or tangent method, timates the stress-strain curves with a hyper- Analysis of incremental construction is possi- h the tangent method. The third analysis is a elastic technique. The stresses and displace- predicted by the finite element method for s loading conditions during construction are esented herein. (Palmerton-WES) 3328

N OF OVERFLOW ROCKFILL DAMS,
sche Hochschule, Munich (West Germany).
ung, and H. Scheuerlein.
International Congress on Large Dams, al, Canada, Vol 1, Quest No 36, p 587-598, 970. 12 p, 6 fig, 6 ref.

tors: *Rockfill dams, Spillways, *Spilling, control, *Overflow, Foreign research, nics, Erosion, Laboratory tests, *Dam Investigations, Turbulence, Boundary Aeration, Turbulent flow, Roughness, Ener- pation, Analytical techniques, Dams.
ers: German Federal Republic, Cost , Dam stability, Overtopping.

part of the total cost of a rockfill dam is d to provide flood control structures that ely used. Omitting the flood control struc- uld save building and operating costs. Such ngement would require permitting overflow dam, something not usually done with dams. This paper discusses flow over such The economical advantage of overflow is ed with resulting disadvantages. The n of highly accelerated flow down the sur- the dam is studied carefully. As a result of ental investigation s of flow in steep, rough, channels, conducted at the Hydraulics h Station of the Technical University of at Obernach, Germany, an analytical for approaching the problem is explained. are provided to simplify working with the ns. An example is presented to demonstrate of the graphs. (USBR) 349

APPLICATION OF BITUMEN FOR AND ROCKFILL DAMS,
ternational Petroleum Co. Ltd., London d); and Shell A. G., Hamburg (West Ger-
er, E. Schoenian, and F. F. Poskitt.
nternational Congress on Large Dams, l, Canada, Vol 1, Quest No 36, p 631-659, 70. 29 p, 10 fig, 3 tab, 8 ref.

ors: *Earth dams, *Rockfill dams, Bitu- Cores, Rollers, *Bituminous materials, Im- materials, Uplift pressure, Asphalt, Dam Durability, Field tests, Revetments, Asphal- rete, Compaction equipment, Flexibility, ovements, Foreign design practices, Dams, riteria, Impervious membranes.
rs: Great Britain, *Asphalt membranes, nell Dam, Northern Ireland, Construction

bitumen for earth and rockfill dams is g more established. By the end of 1968, 65 re sealed and protected with bituminous . Bitumen can be applied either as an ex- vetment or as an internal core. Use of bitu- ne design of the body of a dam is discussed. operties of bituminous materials are d and advantages of flexibility are d. Attention is given to the design of the nixes used and to the different application techniques possible. The advantages and limitations of the various systems are discussed. Examples of recently constructed dams outside the United Kingdom are given, and the first bitumen-lined dam built in the United Kingdom, the Dungonnell Dam in Northern Ireland, is described. A list of dams constructed with bituminous materials is included. (USBR)
W71-03350

PREVENTION OF CRACKING IN EARTH DAMS,
Bureau of Reclamation, Denver, Colo.
F. C. Walker.
Tenth International Congress on Large Dams, Montreal, Canada, Vol 1, Quest No 36, p 361-370, June 1970. 10 p.

Descriptors: Dams, *Earth dams, Dam design, *Cracking, *Cracks, Shear cracks, Dam foundations, Collapse, Safety, Corrections, Classification, Differential settlement, Stress, Slopes, Treatment, Displacements, Soil mechanics, Deformation, Remedies, Seepage.
Identifiers: Crack control, Construction control, Collapse phenomenon, Collapsing soils, Preventive maintenance, Slip planes.

Prevention of cracking in earth dams or correction of cracking that does occur requires a knowledge of the various conditions under which cracking happens. A classification system based on type of stress (tension, compression, or shear), surface slope (flat or steep), and stress-inducing agency (moisture change, temperature change, overloading, unloading, and differential loading) is examined for the circumstances under which cracking occurs. Seriousness of the effect of various types of cracking depends upon the critical engineering properties of the structure and foundation involved, and in consequence, whether prevention or corrective action is necessary. Preventative or corrective actions for each type listed in the classification system are described. Several case histories of rare or obscure situations that do not form a part of the usual experience of practicing engineers but that are of sufficient importance to require inclusion in any comprehensive consideration of the influence of cracking on earth dam design are presented. (USBR)
W71-03351

PRECOMPRESSION FOR IMPROVING FOUNDATION SOILS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
S. J. Johnson.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM1, p 111-144, Jan 1970. 34 p, 27 fig, 2 tab, 52 ref, 3 append.

Descriptors: *Preconsolidation, Embankments, Fills, *Foundations, Soil stabilization, Settlement (Structural), *Soil mechanics, Bibliographies, Loose soils, Design, Compression, Consolidation, Analytical techniques, Relief wells, Drains, Pore pressure, Pore water pressures, Safety factors.
Identifiers: *Preloading, Compressible foundation, Compressible soils, Secondary consolidation, Surcharge.

Precompression of weak and compressible subsoils (with or without vertical sand drains to accelerate consolidation) to increase strength and decrease postconstruction settlements to tolerable amounts is discussed with references to uses and design procedures. Precompression is an effective way of eliminating, in advance of construction of structures or roads, primary consolidation and a portion of secondary compression that would otherwise occur. The amount of secondary compression that is avoided by precompression can be estimated reasonably well, and the surcharge fill can be designed to reduce the remaining secondary compression settlements to tolerable amounts. Design procedures for minimizing secondary compression effects are presented. (USBR)
W71-03355

FOUNDATION PRECOMPRESSION WITH VERTICLE SAND DRAINS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
S. J. Johnson.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM1, p 145-175, Jan 1970. 31 p, 30 fig, 2 tab, 44 ref, 2 append.

Descriptors: *Preconsolidation, Compression, Consolidation, *Sand drains, *Vertical drains, Settlement (Structural), Drainage wells, Soil mechanics, Soil stabilization, *Foundations, Loose soils, Drainage, Pore pressure, Relief wells, Foundation investigations, Design, Installation, Bibliographies.
Identifiers: *Preloading, Compressible foundation, Surcharge, Secondary consolidation, Construction methods, Construction control.

Foundation precompression using preload fills combined with vertical sand drains to accelerate consolidation is described. Uses, design procedures, and possible effects of alternative methods for installing vertical sand drains are discussed. Vertical sand drains to accelerate consolidation are probably not required in soils containing continuous intermediate sand layers within the compressible stratum, but pressure-relief wells may be required to reduce excess pore-water pressures in the sand layers. Pressure-relief wells can be sand drains, free-flowing wellpoints, or conventional wells. Vertical sand drains will probably serve no purpose where design loadings will not exceed preconsolidation stresses. Field tests may be required in some stratified materials to evaluate the drainage efficacy of thin layers of pervious soils. The importance of designing for secondary compression effects is emphasized. (USBR)
W71-03356

SOME LOADING TEST ON LONG PIPE PILES,
Golder, Brawner and Associates Ltd., Vancouver (British Columbia).
N. R. McCammon, and H. Q. Golder.
Geotech, Vol 20, No 2, p 171-184, June 1970. 14 p, 10 fig, 3 tab, 7 ref.

Descriptors: Pile driving, *Skin friction, *Piles (Foundations), *Pile friction, Cohesive soils, Cohesionless soils, *Steel piles, Time, Pipes, *Pile bearing capacities, Pile foundations.
Identifiers: Loading tests, *Pile tests.

Two 24-in.-dia steel pipe piles were driven, one into granular and the other into cohesive soil, and test loaded to measure separately the skin friction and end-bearing components of the pile capacity. The paper describes the tests and presents the pertinent geotechnical properties of the subsoil at each test pile. The values of skin friction and end-bearing are reported. The pile driven into the cohesive soil was test loaded at various times after driving to determine any change in pile capacity with time. A FEATURE OF THE SITE WAS THE PRESENCE OF ARTESIAN WATER PRESSURES IN THE SOIL. The computed and measured values of pile capacity are compared. The skin friction and end-bearing values determined in the tests are used to estimate the bearing capacity of 60-in.-dia steel pipe piles to be driven at the site. (USBR)
W71-03360

THE DYNAMIC PENETRATION TEST: A STANDARD THAT IS NOT STANDARDIZED,
Illinois Univ., Urbana; La Plata Univ. (Argentina); and Sao Paulo Univ. (Brazil).
H. O. Ireland, O. Moretto, and M. Vargas.
Geotechnique, Vol 20, No 2, p 185-192, June 1970. 8 p, 4 fig, 4 ref.

Descriptors: Test procedures, Errors, Drilling, Sampling, Equipment, *Pentration tests, Penetration resistance, Soil mechanics, Samplers, *Soil tests, Soil dynamics, Foundation investigations.
Identifiers: Dynamic tests, Site selection.

A description and a discussion of the technique of making the so-called standard penetration test used in North and South America are presented. Dynamic penetration tests such as the SPT are used for obtaining results that can be interpreted by engineers on a universal basis, but results are often a compromise because of details in the test procedure. The testers usually change the procedure of the test or the dimensions of the tools and continue to call it standard, apparently not realizing that changes cause variations in the penetration resistance number N. To consider the various implications of the method properly, a procedure for boring, sounding, and sampling is described; the SPT in its original form is described; as examples of variations, 2 modified and improved samplers and test procedures used in South America are mentioned; and the applicability and scope of the test are discussed. (USBR)
W71-03361

AN INVESTIGATION OF A CONE-PENETROMETER METHOD FOR THE DETERMINATION OF THE LIQUID LIMIT,
Road Research Lab., Crowthorne (England).
P. T. Sherwood, and M. D. Ryley.
Geotechnique, Vol 20, No 2, p 203-208, June 1970. 8 p, 5 fig, 3 tab, 13 ref.

Descriptors: Atterberg limits, Test procedures, Errors, Apparatus, *Liquid limits, *Penetrometers, *Soil tests, Soil mechanics, Soil physical properties.
Identifiers: Cone penetrometer test.

Recent investigations in the U K and in the U S show that results of the liquid limit test made with the Casagrande apparatus might give wide variations when results obtained by different laboratories are compared. The U S Road Research Laboratory has undertaken an examination of methods of reducing this variation. One possibility is that much of the variation is inherent in the Casagrande apparatus; one suggestion was that the Casagrande test should be replaced by one of the many conepenetrometer methods used in many countries. This paper describes an investigation to determine if one of the cone-penetrometer methods would be an acceptable alternative to the Casagrande test. (USBR)
W71-03362

ON SUBSIDENCE OF LOESS SOILS OF THE UKRAINE,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
For primary bibliographic entry see Field 02F.
W71-03406

CONSIDERATION ABOUT THE COMPACTION MECHANISM OF STRATUM LYING AT THE DEEPER HORIZON IN TOKYO LOWLAND,
Hirosaki Univ. (Japan). Dept. of Pedagogics.
For primary bibliographic entry see Field 02F.
W71-03407

SOME PROBLEMS OF TIME-SOIL COMPACTION IN PUMPING LIQUID FROM A BED,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02F.
W71-03408

LAND SUBSIDENCE, EARTH FISSURES AND GROUNDWATER WITHDRAWAL IN SOUTH-CENTRAL ARIZONA, U.S.A.,
Geological Survey, Phoenix, Ariz.; and Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03409

LAND SUBSIDENCE AND AQUIFER-SYSTEM COMPACTION, SANTA CLARA VALLEY, CALIFORNIA, USA,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03410

FIELD MEASUREMENT OF AQUIFER-SYSTEM COMPACTION, SAN JOAQUIN VALLEY, CALIFORNIA, USA,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03411

ON THE VARIATION OF ARTESIAN HEAD AND LAND-SURFACE SUBSIDENCE DUE TO GROUNDWATER WITHDRAWAL,
Saitama Univ., Urawa (Japan).
For primary bibliographic entry see Field 02F.
W71-03412

SOME PROBLEMS AND RESULTS OF LABORATORY AND FIELD INVESTIGATIONS INTO ROCK MOVEMENTS CAUSED BY WATER MIGRATION IN LOOSE GRANULAR GROUNDS IN HUNGARY,
Hungarian Mining Research Inst., Budapest.
For primary bibliographic entry see Field 02F.
W71-03413

INFLUENCE OF SUBSIDENCE ON BOTH SURFACE AND UNDERGROUND HYDROLOGY (FRENCH),
Ghent Rijksuniversiteit (Belgium).
For primary bibliographic entry see Field 02F.
W71-03414

GEOLOGICAL AND GEOHYDROLOGICAL PROPERTIES OF THE LAND SUBSIDED AREAS-CASE OF THE NIIGATA LOW LAND,
Ministry of Agriculture and Forestry, Niigata (Japan). Hokuriku Regional Office.
For primary bibliographic entry see Field 02F.
W71-03415

WATER BALANCE INVESTIGATION BASED UPON MEASUREMENTS OF LAND SUBSIDENCE CAUSED BY GROUNDWATER WITHDRAWAL,
District Water Authority, Pecs (Hungary).
For primary bibliographic entry see Field 02F.
W71-03416

SIMULATION OF GROUNDWATER BALANCE AS A BASIS OF CONSIDERING LAND SUBSIDENCE IN THE KOTO DELTA, TOKYO,
Tokyo Univ. (Japan). Faculty of Science.
For primary bibliographic entry see Field 02F.
W71-03417

GROUND SINKING IN SHIROISHI PLAIN, SAGA PREFECTURE,
Ministry of Agriculture and Forestry, Tokyo (Japan). Kanto Regional Office.
For primary bibliographic entry see Field 02F.
W71-03418

EXPERIMENTS ON WATER INJECTION IN THE NIIGATA GAS FIELD,
Geological Survey of Japan, Tokyo.
For primary bibliographic entry see Field 02F.
W71-03419

PREDICTION OF FUTURE SUBSIDENCE ALONG DELTA-MENDOTA AND SAN LUIS CANALS, WESTERN SAN JOAQUIN VALLEY, CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03420

AN EXAMPLE OF GROUND SUBSIDENCE ESTIMATION,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 02F
W71-03421

ANALYTICAL METHODS FOR PREDIC SUBSIDENCE,
Woodward-Clyde-Sherard and Asso
Oakland, Calif.
For primary bibliographic entry see Field 02F
W71-03422

A THEORETICAL APPROACH TO ST STRAIN RELATIONS OF CLAYS,
Kyoto Univ. (Japan). Dept. of Civil Engineeri
For primary bibliographic entry see Field 02F
W71-03423

WATER PERMEABILITY AND PLA INDEX OF SOILS,
Kanazawa Univ. (Japan). Dept. of Engineerin
For primary bibliographic entry see Field 02F
W71-03424

RELATIONSHIP OF CONSOLIDA CHARACTERISTICS AND ATTER LIMITS FOR SUBSIDING SEDIMENTS IN TRAL CALIFORNIA, U.S.A.,
Geological Survey, Denver, Colo. Water Reso
Div.
For primary bibliographic entry see Field 02F
W71-03425

VISCO-ELASTIC THEORY OF THE DE MATION OF A CONFINED AQUIFER,
Kyoto Univ. (Japan). Disasters Preve
Research Inst.
For primary bibliographic entry see Field 02F
W71-03426

COMPRESSION OF THE PEAT-BOGS A DRAINING,
For primary bibliographic entry see Field 02F
W71-03427

SUBSIDENCE OF ORGANIC SOILS IN U.S.A.,
Agricultural Research Service, Athens, Ga
and Water Conservation Research Div.
For primary bibliographic entry see Field 02F
W71-03428

PREDICTION OF HORIZONTAL MOVEM DUE TO SUBSIDENCE OVER MINED ARE
California Univ., Los Angeles. Dept. of Eng
ing.
For primary bibliographic entry see Field 02F
W71-03429

ANALYSIS OF PILE GROUP BEHAVIOR,
Materials Research and Development,
Oakland, Calif; Ohio State Univ., Columbus
Dames and Moore, San Francisco, Calif.
K. Nair, H. Gray, and N. C. Donovan.
Amer Soc Test Mater Spec Tech Publ 444, p
159, 1969. 42 p, 16 fig, 6 tab, 13 ref, append.

Descriptors: *Pile groups, Batter piles, Horiz
loads, Analysis, Deformation, Bending mon
Stress, Theoretical analysis, Settlement, *Fou
tions, *Pile foundations, Pile friction, Pile l
loads, *Piles (Foundations), Computer
gramming.
Identifiers: Pile tests, Computer applications.

A procedure for the 3-dimensional analysis o
groups subject to horizontal and vertical force
moments which accounts for batter piles, the l
ral resistance of the piles, and the lateral resis
of the surrounding soil is discussed. Because o
extensive amount of computational effort req
to analyze a pile group, the analysis was
grammed for a digital computer. Results obt

nalyzing several pile group arrangements for
s soil and loading conditions include the axial
moments, stresses, and deflections for in-
l piles and for group piles. Numerical results
he significant influence that the following
have on loads that are introduced in the
individual piles: (1) the arrangement of the
ual piles within the group, (2) the end condi-
reflected by the connection between the pile
d the piles, (3) the lateral resistance of the
nding soil, and (4) the flexural resistance of
e. Comparing field and laboratory tests in-
that the behavior of pile groups predicted
analysis is in qualitative agreement with ob-
behavior. (USBR)
3740

**SAFETY FACTOR IN EXCAVATIONS
OUNDATIONS,**
gineering Testing Co., Atlanta, Ga.
wers.
y Research Record No 269, p 23-34, 1969.
ig, 1 tab, 2 ref.

tors: *Foundations, *Excavation, Failures,
actors, Soil mechanics, Statistical analysis,
Loads (Forces), Soil properties.
ers: Empirical methods.

ety design and safety factor in excavations
ndations are discussed. The resistance to
is provided by an assemblage or system of
al components. Three approaches are
ed: (1) statistical analysis, (2) the com-
approach, and (3) the empirical approach.
tical analysis becomes unreliable at the ex-
low probabilities that must be considered
n. The component approach uses varying
actors to be applied to the loads acting on
cture as well as to the various soil properties
analysis. Safety factors are also applied to
ponents of soil strength individually. This
h is judged sound, but additional com-
of the safety factor are necessary because
ncertainties in the accuracy of the engineer-
ysis used. The empirical approach is that of
ll safety factor developed from experience.
se of the empirical approach requires that
a full study of all failures that occur so that
ce of error can be pinpointed and the un-
es involved in loading, evaluation of re-
s, and engineering analysis can be
ed. (USBR)
741

**CHNICAL CONSIDERATIONS OF
AL STRESSES,**
Univ., Ithaca, N.Y.
nkel.
pecial Conference on Lateral Stresses
Design Earth-Retaining Structures, Cor-
, Ithaca, N Y, p 1-49, June 1970. 49 p, 19
f, append.

ors: *Earth pressure, Soil mechanics,
Swelling, Active pressures, Passive pres-
Consolidation, Bibliographies, Pore water
s, *Overconsolidation, *Clays, Excavation,
l, *Effective stress, *Stress-strain curves,

rs: Geotechnics, Stress paths, Plane strain.

ions involving earth pressures, the con-
n of a somewhat simplified stress system is
enable the interrelation between the ac-
passive stresses to be seen and to provide a
basis for the use of engineering judgment
he particular excavation will behave. The
of this paper is on understanding the
of clay soils in normally consolidated and
solidated conditions. Changes in stability
d with the dissipation of excess pore water
set up during construction are discussed.
cases, the original deposits of normally
ated clays have been uplifted and sub-
the processes of erosion which have
many hundred or even thousands of feet
of the overlying sediments. Vertical effective stresses have been reduced, swelling in the vertical direction has taken place, and lateral stresses have changed. Heavily overconsolidated clays may be at or near a state of passive failure at shallow depths. Shear zones, in which the strength is lower than in the intact clay, may have been created. The existence of these shear zones may be important in lateral stress problems. Has 32 references. (USBR)
W71-03747

BRACED EXCAVATIONS,
Massachusetts Inst. of Tech., Cambridge.
T. W. Lambe, and E. K. Turner.
1970 Special Conference on Lateral Stresses Ground Design Earth-Retaining Structures, Cornell Univ, Ithaca, N Y, p 149-218, June 1970. 70 p, 43 fig, 1 tab, 27 ref, append.

Descriptors: Bracings, Excavation, *Analytical techniques, Field data, Reviews, Soil mechanics, Design, *Lateral forces, *Earth pressure, Earth movements, Soil pressure, Pore water pressures, Stress, Trenches, *Cuts, Strain Loads (Forces), Supports, Bibliographies, *Retaining walls, Load distribution, Settlement (Structural), Movement, Performance.
Identifiers: Design practices.

This review of the state-of-the-art of braced excavations includes: (1) an overview of the excavation problem and factors that influence the behavior of an excavation; (2) several key fundamentals that are widely misunderstood or ignored; (3) predictions of performance of 3 excavations by several analytical techniques, and comparisons of measured field performance to the predictions; and (4) a proposed step-by-step approach to the engineering of a braced excavation. Various methods of analysis are discussed and evaluated. Field measurements and analysis of the 3 excavations showed that: (1) pore pressures were far below static values; (2) steady-state seepage analysis gave reasonable predictions of pore water pressures; (3) bracing strut loads varied widely; (4) significant movements occurred below the bottom of the excavations; (5) much smaller movements occurred behind the reinforced concrete wall than behind the sheet pile walls; (6) significant settlements occurred far back from the excavation; and (7) a significant portion of the settlement can be attributed to consolidation settlement. The general conclusion is that strut loads and movements of soil outside an open excavation cannot be predicted with confidence using present methods of analysis. (USBR)
W71-03748

DESIGN OF EARTH RETAINING STRUCTURES FOR DYNAMIC LOADS,
California Univ, Berkeley; and Massachusetts Inst. of Tech., Cambridge.
H. B. Seed, and R. V. Whitman.
1970 Special Conference on Lateral Stresses Ground Design Earth-Retaining Structures, Cornell Univ, Ithaca, N Y, p 103-147, June 1970. 45 p, 32 fig, 5 tab, 31 ref.

Descriptors: Earthquakes, *Retaining walls, Design, Model tests, Water pressure, Design criteria, Soil mechanics, *Lateral forces, Blasts, Soil pressure, Explosions, Failure (Mechanics), Analytical techniques, Safety factors, Bibliographies, Live loads, Reviews.
Identifiers: Earthquake damage, *Dynamic loads, Dynamic tests, Seismic stability, Design practices, Recommendations, *Earthquake loads.

A review of the state of knowledge concerning the design of earth-retaining structures for increased lateral pressures caused by earthquakes, explosions, or blasts is presented. The general practice in the U S and many other countries is to make no special allowance for dynamic loads caused by earthquakes. Several failures are cited to show that increased lateral pressure must be considered a significant design problem in seismic regions. Methods for determining dynamic lateral pressures on retaining structures above and below the water table are reviewed, and recommendations for earthquake-resistant design are presented. The design of structures for protection against explosions and the maximum accelerations allowed to avoid damage to retaining walls and freshly placed concrete from nearby blasting are discussed. (USBR)
W71-03749

ABOUT THE SAFETY FROM SUBSURFACE EROSION OF EARTH DAMS SUBJECTED TO UNDERSEEPAGE,
Technische Hochschule, Darmstadt (West Germany).
H. Breth, and K. Gunther.
10th International Congress on Large Dams, Montreal, Can, Vol 2, Quest No 37, p 431-451, June 1970. 21 p, 9 fig, 24 ref.

Descriptors: Seepage, *Underseepage, Safety, Dams, *Earth dams, Dam design, Uplift pressure, Dam foundations, Pervious soils, Subsurface flow, Soil mechanics, Blowouts, Analytical techniques, Sand boils, Heaving, Percolation, Foreign research, Foundation failure, Bibliographies.
Identifiers: Seepage control, Design practices, *Piping (Erosion), German Federal Republic.

The potential theory method and Lane's method of assessing the safety from subsurface erosion of dams subjected to underseepage are compared, and the practicability and limits of applicability are investigated. Lane's method can lead to dangerously inaccurate estimates of the safety of dams founded on stratified subsoil and to extremely uneconomical designs, especially when a large head difference exists between the upstream and downstream sides of the dam and when filter layers or drainage systems are provided. The potential theory method in some cases gives criteria causing difficulties and uncertainties in estimating safety from erosion, but experience shows that the method leads to economical designs safe from subsurface erosion when applied with care. Lane's method should be used only for small dams founded on largely homogeneous soils; the potential theory method should be used for all other cases. (USBR)
W71-03750

NEW TECHNIQUE OF SLUICING SCREENED STONES WITH SAND AND LOAM AS PERFORMED IN THE HIGH ASWAN DAM,
Aswan High Dam (United Arab Republic). Technical Research Dept.
M. E. Hassouna, W. K. Shenouda, and K. Nashed.
10th International Congress on Large Dams, Montreal, Can, Vol 2, Quest No 37, p 777-792, June 1970. 16 p, 9 fig.

Descriptors: Construction, *Rock fills, *Rockfill dams, Voids, Earth dams, Testing, Foreign construction, Underwater construction, Quality control, Cofferdams, Screening, Hydraulic transportation, *Hydraulic fills, Dam construction, Gradation, River closures.
Identifiers: Aswan Dam, UAR (United Arab Republic, Construction control, Construction methods, *Sluicing.

Sluicing with sand, delivered in the form of a hydraulic pulp, to fill the voids of rockfill in the High Aswan Dam in the United Arab Republic is described. Sluicing was successful above and below water and was performed to: (1) decrease seepage through the dam, (2) avoid piping, and (3) eliminate the need for constructing an inverted filter in deep flowing water. Studies to furnish data about the nature of sluicing, factors affecting the process, methods of delivery of sand, optimum gradation of rockfill, and efficiency of the sluicing method are discussed. Construction control procedures are described. Screening of the rockfill materials to be sluiced was necessary for successful void filling. (USBR)
W71-03751

FILLING AND COMPACTION OF SAND BY DEEP VIBRATORS AND VIBROROLLERS IN THE HIGH ASWAN DAM,
High Aswan Dam (United Arab Republic). Technical Research Dept.
M. E. Hassouna, and W. K. Shenouda.
10th International Congress on Large Dams, Montreal, Can, Vol 5, Gen Rep, p 411-432, June 1970. 22 p, 12 fig.

Descriptors: *Earth dams, *Compaction, Compaction equipment, Dune sands, Compaction tests, *Hydraulic-fill dams, Hydraulic fills, Density, Penetration resistance, Penetration tests, Penetrometers, Field tests, Dam construction, Foreign construction, Dam design, Quality control, Hydraulic transportation, Soil compaction.
Identifiers: *Vibratory compaction, United Arab Republic, Aswan Dam, UAR, Permeability tests, Construction methods.

In constructing the High Aswan Dam in the United Arab Republic, a technique of hydralically placing dune sand on both sides of a clay core and compacting it with deep vibrators or vibrorollers was used successfully and economically. The first part of the fill was placed under water at a depth of up to 35 m in 2 layers each 14-15 m thick. The underwater part of the fill was compacted, using deep vibrators working from floating rigs, to a depth of 15 m under a water depth of up to 19 m. Deep vibrators and methods used to compact 3,400,000 cu m of dune-sandfill in a 4-mo period are described. That part of the fill above the water surface was hydraulically placed in layers 1.5-2.0 m thick and compacted with vibrorollers. Methods of measuring compaction in the underwater zone and the dry zone of the dam are discussed. (USBR)
W71-03752

FOUNDATION INSTRUMENTATION AT PLEASANT VALLEY PUMPING PLANT,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
William H. Roth.
Available from NTIS as PB-195 272, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Report REC-OCE-70-23, June 1970. 32 p, 24 fig, 2 tab, 1 ref.

Descriptors: Instrumentation, *Foundations, Stress concentration, Pore pressure, Stress distribution, *Earth pressure, *Uplift pressure, Walls, Pore water pressures, Flow nets, Structural stability, Performance, Land subsidence, Stability analysis, Field data, *Piezometers, *Drains, *Soil pressure, Lateral forces, Settlement (Structural), Safety factors, California.
Identifiers: Pleasant Valley Pumping Plant (Calif), Stress gages, Deep subsidence, *Stress meters.

Stress meters and piezometers were installed at Pleasant Valley pumping plant in California to record soil and pore pressures underneath and along the back wall of the structure and to monitor functioning of a drain that was constructed along the base of the back wall to reduce uplift pressure under the structure and horizontal pressure on the wall. Included in the report are: (1) a discussion of conditions prompting the drain and instrumentation installation; (2) drawings showing features of the pumping plant and pumping plant excavation; (3) drawings showing locations and details of installation of the stress meters and piezometers; (4) logs of drill holes showing foundation conditions; (5) a description and drawings showing results of an electrical analogy tray study to determine the flow net for the high cut slope adjacent to the pumping plant; (6) a discussion and drawings showing results of stability studies made for the structure; (7) plots showing stress meter and piezometer reading through Feb 2 and Feb 12, 1970, respectively; (8) plots of wall pressures determined from the stress meter readings; and (9) a discussion of unexpected stress meter and piezometer readings and possible explanations.
W71-03767

8E. Rock Mechanics and Geology

HEAD LOSSES IN UNLINED ROCK TUNNELS,
Royal Inst. of Tech., Stockholm (Sweden).
For primary bibliographic entry see Field 08B.
W71-03735

ENGINEERING AND ROCK MECHANICS,
C. Jaeger.
Water Power, Vol 22, No 5/6, 7/8, p 203-209, 253-259, May/June, July/Aug 1970. 14 p, 25 fig, 3 tab, 58 ref.

Descriptors: *Rock mechanics, Rock foundations, Rock properties, Dams, *Rockslides, *Concrete dams, *Dam foundations, *Dam failure, Dam design, Engineering geology, Engineering, Uplift pressure, Hydrostatic pressure, Grout curtains, Laboratory tests, Analytical techniques, Bibliographies, Fractures (Geology), Strength, Slope stability, Safety.
Identifiers: Rockfalls, *Rock slope stability, Rock tests, Malpasset Dam, France, In situ tests, Vaiont Slide, Italy, Dam stability.

Rock conditions, methods used for testing rock, and choice of solutions of problems for several concrete dams are described to show to what extent known methods of rock mechanics can be used in solving engineering problems and to what extent present knowledge of rock properties is lacking and insufficient for clear technical decisions. Some proposed changes in the treatment of foundations for concrete dams, methods of analysis of galleries and excavations in rock, rock slope stability, and several major rockslides are discussed. Analysis of conditions leading to the Malpasset Dam failure in France and to the Vaiont rockslide in Italy are given special attention. Has 58 references. (USBR)
W71-03736

8F. Concrete

CONCRETE BEAMS WITH PRESTRESSED REINFORCEMENT,
Ohio State Univ., Columbus.
A. Bishara, and F. N. Almeida.
Proc Amer Soc Civ Eng, J Struct Div, Vol 96, No ST7, p 1445-1460, July 1970. 16 p, 5 fig, 4 tab, 10 ref, 2 append.

Descriptors: *Beams (Structural), *Reinforced concrete, Reinforcement, Prestressed concrete, Precast concrete, Cracking, Deflection, Moments, Structural behavior, Structural members, Analytical techniques, Strain, Elasticity modulus, Laboratory tests, Structural engineering.
Identifiers: Reinforcing materials, Composite systems, *Composite beams, Strain hardening, Ultimate strength.

Test on 6 rectangular beams reinforced with variable amounts of deformed steel bars and precast prestressed concrete prisms are reported. Methods are suggested for computing the moment causing cracking of in situ concrete and that causing cracking of prestressed reinforcement. After cracking of prestressed reinforcement, and up to the beginning of yield of nonprestressed tension reinforcement, flexural analysis can be done using assumptions of classic working stress design by associating to the combined area of strand and deformed bars a pseudo-modulus of elasticity higher than that of ordinary steel. During this stage for similar beams having equal total areas of tension reinforcement, the ratio between their maximum crack widths was practically equal to the inverse of their respective pseudo-moduli. Strain hardening effects should be taken into consideration in estimating ultimate moment capacity of beams reinforced with such composite reinforcement. (USBR)
W71-03354

CONCRETE-POLYMER MATI DEVELOPMENT,
Brookhaven National Lab., Upton, N.Y.
M. Steinberg.
Nuclear News, Vol 13, No 9, p 48-54, Sept p, 4 fig, 4 tab, 3 ref.

Descriptors: *Concrete technology, C mixes, Radiation, Concrete testing, *Co Composite materials, Impregnation, Mo Costs, Materials, Materials engi *Polymers, Research and development, C properties, Physical properties, Durability, struction materials, Strength, Mechanical ties.
Identifiers: *Polymerization, *Concrete-p materials, *Concrete properties, *P concretes.

Findings of a cooperative research program way to investigate and develop concrete-p composites as new construction materia presented. Methods of impregnating concrete with monomers, selection of mon polymerization techniques, and pre monomers with concrete before curin discussed, and the following data are presente properties of concrete with and without po (2) effects of temperature and polymer cont the compressive strength of concrete; (3) p ties of lightweight concrete containing po (4) a comparison of properties and co concrete-polymer materials to basic constr materials; and (5) composition and compr strength of several concrete-polymer materia polymer-concrete composites. Concrete pregnated with methyl-methacrylate shows in sive improvements in strength, durability watertightness. Based on preliminary estimate cost of concrete-polymer sewer pipe produc radiation treatment is about double the cost dinary concrete pipe containing the same vo of concrete. Use of concrete-polymer materi structural purposes appears economically fe because considerable less volume of con polymer is required to produce strengths equ ordinary concrete. (USBR)
W71-03734

THE PROPERTIES OF AN EPOXY MOR AND ITS USE FOR STRUCTURAL JOINTS,
Selwyn Coll., Cambridge (England).
R. P. Johnson.
Structural Engineering, Vol 48, No 6, p 227- June 1970. 7 p, 8 fig, 2 tab, 10 ref, append.

Descriptors: *Concrete technology, *Epoxy re Compression, Foreign research, Structural de *Joints (Connections), Mortar, Creep, S strength, Aggregates, Compressive stren Elasticity modulus, Testing, Stress-strain cu Shrinkage, Adhesives, Test specimens, Pre concrete.
Identifiers: *Epoxy mortar, Creep tests, G Britain, Test results, Foreign testing, Fatigue tes

Formulation of an epoxy mortar intended for us structural joints is discussed with relation to re work on mix design. Results of extensive tests creep and ultimate strength show that the ep mortar is suitable for use in structural joints precast concrete that transmit combined shear compression, and that its flexibility and creep little greater than that of concrete. Resin mo mixes are discussed, with particular emphasis Mix M used in the tests described. Conclusions that concrete structures containing joints m with an epoxy mortar similar to that tested may designed as if they were monolithic. (USBR)
W71-03738

PRESTRESSED CONCRETE LINING OF ROCKFILL DAM,
Research Inst. for Civil Engineering, Bratislava (zechoslovakia).
L. Hobst.
Tenth International Congress on Large Dam Montreal, Can, Vol 1, Quest No 36, p 207-2 June 1970. 7 p, 4 fig.

iptors: *Dams, *Rockfill dams, Impervious
s, Prestressing, Concretes, Deformation,
tressed concrete, Flexibility, Cutoff walls,
ruction.
fiers: *Dam facings.

essing the concrete facing on the upstream
f a rockfill dam increases the flexibility of the
and its adaptability to deformations of the
Construction of the prestressed concrete fac-
a rockfill dam at Skalka, Czechoslovakia, is
bed. The lining was prestressed in one
ion only--parallel with the slope--using cables
factured of spliced steel ropes and a
essing force of 70 Mp. The spacing of cables
tted placing the concrete facing by a machine
g along the slope of the upstream face of the
Control measurements proved that the
d prestressing was attained. Construction of
ning with prestressed concrete proved to be
atisfactory. (USBR)
03744

CRETE MASONRY STRUCTURES--
GN AND CONSTRUCTION.
can Concrete Inst. Detroit, Mich. Committee

er Concr Inst, Proc Vol 67, No 5, 6, p 380-
42-460, May, June 1970. 43 p, 6 fig, 7 tab, 2
d.

iptors: *Masonry, *Structural design,
ifications, Design, Admixtures, Construction,
g, Anchors, Backfill, Deflection, Beams
tural), Cold weather construction, Columns,
ressive strength, Structures, Foundations,
orcing steel, Grouting, Loads (Forces), Mor-
hear stress, Wind pressure, Thermal expan-

fiers: *Concrete blocks, Control joints, Bond
th, Bond, Earthquake-resistance struct,
or bolts.

mmendations are provided for the design and
uction of reinforced and nonreinforced
ete masonry structures using units manufac-
to ASTM specifications. The manufacturing
ss is not discussed, and mortarless masonry
construction using resin-type adhesives
en the units are not covered. Design recom-
ations based on the working stress method
llowable stresses for reinforced and nonrein-
masonry. Construction recommendations
e chapters on materials and specifications,
r and grout, preferred construction practices,
mination of masonry strength, inspection,
ctions to embedded and adjoining construc-
and reinforcing bar details. Design chapters
eparately with reinforced walls and columns
onreinforced walls and columns. Shear, bond,
nchorage provisions are given for reinforced
ry. Recommendations for control of wall
ments are made, and construction of masonry
rs, screen walls, and fences is described. Ap-
nately 200 terms relating to masonry design
onstruction appear in the appendix. (USBR)
03754

CT OF SPECIMEN SIZE ON TENSILE
NGTH OF CONCRETE,
tment of Energy, Mines and Resources, Ot-
Ontario).
Malhotra.
er Concr Inst, Proc Vol 67, No 6, p 467-469,
970. 3 p, 3 fig, 3 ref.

iptors: *Concrete technology, Concrete
, Concretes, Research and development,
specimens, *Concrete testing, Water-cement
Splitting tensile strength, *Tensile strength,
rocedures, Foreign research, Statistical anal-
ize, Effects.
fiers: Test results, Canada, *Tension tests,
n testing.

ts of an investigation to determine the effect
cimen size on tensile strength of concrete are presented. Direct-tension, ring-tension, and splitting-tension tests were used during the investigation. Twenty-one concrete mixes were prepared, and 6- and 12-in.-dia rings and 4- by 8-in. and 6- by 12-in. cylinders were cast and tested. Analysis of test results from 276 specimens showed that irrespective of the test method used, tensile strength values decreased with increase in size of the specimens. The average decrease in strength varied from about 14% in the ring-tension test to about 7% in the direct-tension and splitting-tension tests. (USBR)
W71-03755

DEVELOPMENT OF A STRESS RELIEF METHOD WITH A THREE-DIRECTIONAL BOREHOLE DEFORMATOPM GAGE,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
W. G. Austin.
Bureau of Reclamation Report REC-OCE-70-10, Mar 1970. 74 p, 51 fig, 17 tab, 5 ref, append.

Descriptors: Concrete testing, Laboratory tests, Cores, Mass concrete, Elasticity modulus, *Internal forces, *Stress relieving, Deformation, Rock mechanics, Three-dimensional, *Drill holes, *Strain measurement, Core drilling, Boreholes, Research and development, Test procedures, Testing, *Stress, Strain, Analytical techniques, Orientation.
Identifiers: In situ tests, Rock tests, *Borehole deformation gage, *Overcoring method, Testing equipment, *Internal stress.

Laboratory tests and analysis were performed to develop testing techniques and to check a method for determing in situ stress in an isotropic elastic body described in a Bureau of Mines report. The method is based on measuring the diametrical change in a borehole caused by overcoring with a larger-diameter bit, and indicates that measurements in 2 nonparallel, nonperpendicular drill holes are sufficient to determine all 6 components of 3-dimensional stress. Necessary equipment was fabricated, calculations for the 2-drill hole approach were programed for computer analysis, and stress relief tests were performed on 3 biaxially loaded concrete blocks. Test results were analyzed, but solutions were unobtainable. Further study indicated that 3 drill holes are required to obtain solutions. A computer program was prepared for determining stresses for 3 or more drill holes, additional stress relief tests were performed using 3 drill holes, and satisfactory solutions were obtained. Conclusions are: (1) 3 nonparallel drill holes are required to obtain a 3-dimensional stress solution; (2) the stress-relief method using the borehole gage requires complex and precise procedures; and (3) the method is suitable for obtaining stresses in large masses. (USBR)
W71-03757

CEMENTING WATER WELLS,
Halliburton Oil Well Cement Co., Houston, Tex.
For primary bibliographic entry see Field 08A.
W71-03848

8G. Materials

THE APPLICATION OF BITUMEN FOR EARTH AND ROCKFILL DAMS,
Shell International Petroleum Co. Ltd., London (England); and Shell A. G., Hamburg (West Germany).
For primary bibliographic entry see Field 08D.
W71-03350

SOME LOADING TEST ON LONG PIPE PILES,
Golder, Brawner and Associates Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 08D.
W71-03360

THE DYNAMIC PENETRATION TEST: A STANDARD THAT IS NOT STANDARDIZED,
Illinois Univ., Urbana; La Plata Univ. (Argentina); and Sao Paulo Univ. (Brazil).
For primary bibliographic entry see Field 08D.
W71-03361

AN INVESTIGATION OF A CONE-PENETROMETER METHOD FOR THE DETERMINATION OF THE LIQUID LIMIT,
Road Research Lab., Crowthorne (England).
For primary bibliographic entry see Field 08D.
W71-03362

PREVENTING FILAMENTOUS SCALE IN WATER WELLS,
Sayreville Water Works, N.J.
Andrew Piatek.
Water and Wastes Engineering, Vol 4, No 12, p 54-55, December 1967. 9 ref.

Descriptors: *Water wells, *Corrosion, *Iron removal, Well maintenance, Crenothrix, Scale, Colloidal clay.
Identifiers: *Water well chemical treatment, Gallionella sp., Beggiatoa sp., Leptothrix sp., Chlorine dioxide treatment, Calcium hypochlorite, Well surging, Well cleaning, Line cleaning.

Systems of chemical treatment for preventing formation of filamentous scale in well water containing iron bacteria and colloidal clay are reviewed. Laboratory experiments indicate that chlorine dioxide has ability to destroy iron bacteria. The water from wells in the Sayreville, New Jersey area was higher in colloidal clay at certain times than at others. It was assumed that the problem was complicated by iron bacteria using clay as a nucleus to aggregate with other insoluble salts in the formation and by rapid growth of the heavy muck in the system. The treatment was divided into two parts: (1) well surging and cleaning, and (2) line cleaning. The system of treatment has been successful for a year. It also appears that corrosion is being held at a lower level. (Campbell-NWWA)
W71-03835

PERFORMANCE OF ALLOYS AGAINST EROSION - CORROSION ATTACK,
Stainless Foundry and Engineering, Inc., Milwaukee, Wis.
G. Schiefelbein.
Materials Protection, Vol 9, No 6, p 11-13, June 1970. 4 fig, 6 tab, 1 ref.

Descriptors: *Pumps, *Corrosion, Pitting (Corrosion), Chemical degradation.
Identifiers: *Alloy performance, *Erosion-corrosion measurements, Illium PD, Illium 98, CN-7M (Alloy 20), Sulfite processing, Pump repair, Pulp and paper industry, Impeller failure.

The high frequency of pump repair and replacement in the pulp and paper industry prompted a research program to develop an alloy that would resist the attack of abrasive slurries in corrosive media. The comparative performance of alloys commonly used in paper mills is described. According to field test results, Illium PD extended pump life to nearly two years, compared with five months obtained from the commonly used modified CN-7M alloy. (Campbell-NWWA)
W71-03838

SECOND CORROSION STUDY OF PIPE EXPOSED TO DOMESTIC WATERS,
G. B. Hatch, J. F. J. Thomas, and R. W. Lane.
Materials Protection, Vol 9, No 6, p 34-37, June 1970. 3 fig, 3 ref.

Descriptors: *Water wells, *Corrosion, Pitting (Corrosion), Aluminum, Chemical degradation, Water supply.
Identifiers: Domestic water, Pipe exposure study, Galvanized steel, Galvanized wrought iron pipe, Alclad, Water type, Flow velocities, Test installations, Cold water, Copper, Chloride, pH, CaCo3.

An earlier pipe exposure study to establish the corrosivity of several public water supplies to metal ordinarily used for domestic and institutional service pipe demonstrated the need for further study of the factors of quantity and velocity of water flow. Galvanized steel and galvanized wrought iron-pipe were tested under varied controlled and metered flow conditions at cold water temperature for the same 24 hour period as in the earlier study. Alclad and aluminum specimens were also tested. This report concerns the investigation of corrosion by 25 selected types of domestic waters only, with no attempt to cover all domestic waters. The following conclusions were made: (1) specimen types were equal in corrosion resistance to cold water, (2) copper and chloride are the predominant factors causing increased corrosion of the galvanized metals, (3) major problems of this study was experiment duration. Extended durations needed, (4) total flow and velocity factors did not reveal much additional information. However, specimens exposed to intermittent and lower flow rates were more severely corroded, (5) In the case of Alclad and aluminum, dissolved oxygen, copper and chloride were factors which appeared responsible for increased corrosion, except at higher velocities, (6) completely softened (zeolite treated) water, increased corrosion of all metals tested, (7) silicate treatment (8ppmSio2) of high chloride-sulfate water was successful for inhibition. (Campbell-NWWA)
W71-03839

8I. Fisheries Engineering

INDIA EYES THE OCEAN'S RESOURCES,
Science Service, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-03599

MARINE AQUACULTURE,
National Science Foundation, Washington, D.C. Office of Science Information Service.
For primary bibliographic entry see Field 02L.
W71-03772

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

MANPOWER SUPPLY IN WASTE WATER TREATMENT PLANTS,
Purdue Univ., Lafayette, Ind. Water Resources Research Inst.
For primary bibliographic entry see Field 05D.
W71-03521

9C. Research Facilities

A WATER RESOURCES ECOLOGY CAPABILITY FOR THE WATERWAYS EXPERIMENT STATION AND CORPS OF ENGINEERS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. Cairns, and P. S. Humphrey.
Sponsored by Assistant Secretary of the Army (R and D), Department of the Army. U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Contract Report 0-69-1, May 1969. 26 p.

Descriptors: *Ecology, *Research facilities, *Ecosystems.

Reports Waterways Experiment Station capability for filling the existing need for a government agency which can study drainage basins, estuaries, shorelines and bays from the ecological systems viewpoint and provide regional planners with the ecological information which will enable them to plan wisely for the optimization of the resource from the multiple use standpoint. Defines areas of ecological programs. Shows relation of WES ecology capability to planning and implementation of civil projects. Recommends establishment at WES of a water resources ecology study group, formation of a Water Resources Ecology Advisory Board, and selection of a pilot project. (Spivey-WES)
W71-03318

10. SCIENTIFIC AND TECHNICAL INFORMATION

A STUDY OF WATER RESOURCES INFORMATION SERVICES,
Texas A and M Univ., College Station. Coll. of Business Administration.
Eugene B. Smith.
Water Resources Bulletin, Vol 6, No 6, p 907-919, November-December 1970. 13 p, 7 fig, 2 ref. OWRR Project W-103 (No 1609) (5).

Descriptors: *Abstracts, *Information retrieval, *Evaluation, Documentation, Publications, Libraries, Reviews, Surveys.
Identifiers: *Information services.

A study was designed to analyze two types of information services provided by the Water Resources Scientific Information Center (WRSIC). This study was conducted to assess the monetary value and acceptability to users of the Selected Water Resources Abstracts (SWRA) Journal and the Selective Dissemination of Information (SDI) System. Both services were well received and provide a useful and valuable service to a variety of users active in the area of water resources. Major limiting factors associated with the conduct of th study were those involving limited user experienc with the services and the absence of a capability t group the participants according to variou parameters. The SDI service was discontinued dur ing August, 1969 because of budgetary limitations The results of this study indicate that consideratio should be given to resumption of this service whe funding permits. Additional consideration shoul be given to the problem of document acquisition b the user. (Knapp-USGS)
W71-03317

BIBLIOGRAPHY: SCIENTIFIC FUNDAMENTALS OF THE EUTROPHICATION OF LAKES AND FLOWING WATERS, WITH PARTICULAR REFERENCE TO NITROGEN AND PHOSPHORUS AS FACTORS IN EUTROPHICATION,
Organization for Economic Co-Operation and Development, Paris (France).
Richard A. Vollenwider.
Organization for Economic Co-Operation and Development, Ex 40108, 1970. 61 p, 716 ref.

Descriptors: *Bibliographies, *Eutrophication, *Phosphorus, *Nitrogen, Lakes, Rivers, Impoundments, Aquatic life, Plankton, Biomass, Productivity, Trophic level, Nutrients, Water pollution control, Water pollution effects, Water pollution sources, Waste water treatment, Inorganic compounds.
Identifiers: *OECD, *Committee for Research Cooperation, Aquatic blooms, Hydrophytes, Nutrient sources, Nutrient concentrations.

This bibliography contains 716 references pertaining to the problems of eutrophication of inland waters. It is a supplement to paper OECD No 40105, titled 'Scientific fundamentals of the eutrophication of lakes and flowing waters, with particular reference to nitrogen and phosphorus as factors in eutrophication,' (See W71-03447) issued by the Organization for Economic Cooperation and Development (Paris) and is published as a separate paper. (Auen-Wisconsin)
W71-03448

DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT VOLUME I TEST-CASE STUDIES,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
For primary bibliographic entry see Field 05A.
W71-03770

DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT. VOLUME II. THE OVERVIEW SYSTEM,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
For primary bibliographic entry see Field 05A.
W71-03771

NATURAL RESOURCES IN THE GOVERNMENTAL PROCESS A BIBLIOGRAPHY SELECTED AND ANNOTATED,
Arizona Univ., Tucson. Inst. of Government Research.
For primary bibliographic entry see Field 06E.
W71-03804

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- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

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- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 8
APRIL 15, 1971

W71-03851 -- W71-04350

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 8
APRIL 15, 1971

W71-03851 -- W71-04350

funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

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To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

. NATURE OF WATER

3. Aqueous Solutions and Suspensions

NTISTRY PROFESSOR EXPLAINS POLY-ATER.
emical and Engineering News, Vol 49, No 3, p 7, uary 18, 1971. 1 p, 3 photo.

criptors: *Aqueous solutions, *Capillary ac-, *Diffusivity, *Ion transport, Analytical niques, Surface tension, Nucleation, Water or, Quartz, Solvents.
ntifiers: *Polywater, Isocaps.

illary phenomena that affect the behavior of ny liquids may explain the peculiar behavior of ywater, according to materials scientist and tistry professor William J. O'Brien of the higan University dental school. The dissolving ver of liquids is intensified billions of times when r vapors condense in microscopic capillaries. a result, the condensing vapors extract normally oluble ions from the capillary walls. This could ount for the high concentrations of impurities nd by some workers in their preparations of ywater. In developing equations to describe id behavior in isocaps, surface tension of water very thin isocap was found to be 700 dyne per about 10 times normal. This high surface ten- hinders nucleation and prevents vapors from densing by the usual method. Since the drive to dense is very strong, the dissolving power of densing vapor extracts ions from the capillary ls. High-purity quartz contains enough impuri- to account for the ions found in polywater con- sed from triple-distilled water. The slow process olves diffusion of ions through the glass to the rface. (Lang-USGS)
1-03926

RUCTURE OF WATER IN MICROEMUL-NS: ELECTRICAL, BIREFRINGENCE, AND CLEAR MAGNETIC RESONANCE STUDIES,
rida Univ., Gainesville. Dept. of Chemical En- eering; and Florida Univ., Gainesville. Dept. of esthesiology.
esh O. Shah, and Roy M. Hamlin, Jr.
nce, Vol 171, No 3970, p 483-485, February 5, 1. 3 p, 2 fig, 14 ref. FWQA Grant WP 15080 P.

criptors: *Microenvironment, *Water struc-, *Oil-water interfaces, *X-ray analysis, Emul-s, Molecular structure, Electrical resistance, ical properties, Oily water, Chemical proper-, Potassium, Analytical techniques.
ntifiers: *Microemulsions, Water-oil disper-s, Emulsified water.

roemulsions, which are optically transparent water dispersions, were produced by mixing adecane, hexanol, potassium oleate, and water. the amount of water is increased, the roemulsion exhibits a clear to turbid to clear sition. In contrast to the clear regions, the tur- region possesses birefringence. The develop- nt of birefringence is also accompanied by a p decrease in the electrical resistance. The h-resolution (220 megacycle) nuclear magnetic nance data suggest that water exists in two inct molecular environments in the birefringent on; the first environment is characterized by tively less mobile water molecules than oil ecules, whereas in the second environment oil ecules are less mobile than water molecules. electrical, birefringence, and nuclear magnetic nance data are in agreement with the proposed chanism of change in the structure of water n water spheres to water cyclinders to water ellae. The chemical shift of water protons sug- s that the molecular environment of water in eres is different from that of water in cylinders hat of water in lamellae. (Lang-USGS)
1-04108

THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Walter J. Hamer.
For sale by Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402. Price $4.25. National Bureau of Standards Reference Data Series NSRDS-NB24, December 1968. 271 p, 135 tab, 28 ref. NASA Contract R-09-022-029.

Descriptors: *Electrolytes, *Aqueous solutions, *Water chemistry, *Water properties, *Chemical potential, Ionization, Chemical properties, Ions, Data collections, Water quality.
Identifiers: *Activity coefficients (Electrolytes).

Values are tabulated for activity coefficients of electrolytes of various valence types, from 0 to 100 deg C, and for ionic strengths from zero to 0.1 molal or 0.1 molar, as calculated by seven different equations based on the theory of interionic attraction. These equations are those of Debye and Hueckel, Guentelberg, Davies, Scatchard, and Bjerrum, and what may be termed an extended Guentelberg equation and an extended Scatchard equation. (Knapp-USGS)
W71-04183

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
Tyco Labs., Inc., Waltham, Mass.
James N. Butler, John C. Synnott, and Rima Huston.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $1.00. Office of Saline Water Research and Development Progress Report No 606, October 1970. 109 p, 33 tab, 14 fig, 84 ref. OSW Contract 14-01-0001-607.

Descriptors: *Aqueous solutions, Saline water systems, *Desalination, Thermodynamics, Electrolytes, *Electrodes.
Identifiers: Activity coefficient, *Amalgam electrodes.

Research which has been carried out at this laboratory on activity coefficient measurements using amalgam electrodes, glass electrodes, liquid ion-exchange electrodes, and solid state membrane electrodes is briefly reviewed, and the advantages and limitations of each of these methods are discussed. As a primary standard, amalgam electrode measurements are important because of our detailed knowledge of mechanism. Glass electrode measurements give quite accurate activity coefficient data for some systems, but in others show systematic errors which are not yet fully understood. At the present state of the art, liquid ion-exchange electrodes are not extremely stable or selective, but solid state membrane electrodes promise to be superior in both respects, and may provide the possibility of measurements in systems which otherwise could not be studied. (McCoy-Office of Saline Water)
W71-04221

02. WATER CYCLE

2A. General

ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
Illinois Univ., Urbana.
Ven Te Chow, and S. J. Kareliotis.
Water Resources Research, Vol 6, No 6, p 1569-1582, December 1970. 14 p, 8 fig, 16 ref. OWRR Project B-038-ILL (1).

Descriptors: *Stochastic processes, *Mathematical studies, *Mathematical models, Systems analysis, Rainfall-runoff relationships, Statistical methods, Probability, Synthetic hydrology, Regression analysis, Statistical models, Time series analysis.
Identifiers: *Stochastic hydrologic systems.

Hydrologic phenomena are in reality stochastic in nature; that is, their behavior changes with the time in accordance with the law of probability as well as with the sequential relationship between the occurrences of the phenonmenon. To analyze the hydrologic phenomenon, a mathematical model of the stochastic hydrologic system to simulate the phenomenon must be formulated. In this study, a watershed is treated as the stochastic hydrologic system whose components of precipitation, runoff, storage, and evapotranspiration are simulated as stochastic processes by time series models to be determined by correlograms and spectral analysis. The hydrologic system model is then formulated on the basis of the principle of conservation of mass and composed of the component stochastic processes. To demonostrate the practical application of the method of analysis so developed, the upper Sangamon River basin above Monticello in east central Illinois is used as the sample watershed. The watershed system model so formulated can be employed to generate stochastic streamflows for practical use in the analysis of water resources systems. (Knapp-USGS)
W71-03869

THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
J. R. Waugh.
New Zealand Ministry of Works, Water and Soil Division Miscellaneous Hydrological Publication No 6, 1970. 21 p, 15 fig, 7 tab, 25 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow, *Low flow, *Hydrogeology, *Subsurface runoff, Hydrologic data, Foreign projects, Gaging stations, Data collections, Runoff, Discharge measurement, Aquifer characteristics, Water yield, Rivers, Flow rates, Rainfall, Hydrographs, Droughts, Streamflow forecasting.
Identifiers: *New Zealand, Northland (New Zealand), Low-flow data.

Flow data from catchments with uniform geology in Northland, New Zealand are used to show that the geology of the catchment area is the most important influence on the low flows. Fifteen catchments, each on a single rock type, were selected for stream gaging. Later, towards the end of the drought, individual measurements were made at other sites to extend the data for mapping purposes. Chart and punched-tape records from five representative basins and one experimental basin also were collected. It was concluded that: 1. The geology of the catchment area is the main influence on the low flows occurring during a drought. 2. The two, three, and four-monthly rainfall totals for drought periods can be used to allocate an approximate frequency to a particular drought. However, the gaging data available from 1962 and 1968 indicated that antecedent rainfall should also be taken into account in allocating a frequency to a drought. 3. The bulk of the 1968 data available for Northland shows that the concept of using representative basins is quite sound, at least for low-flow data. 4. Catchments in the Waipoua and Whangerei regions (basalt and greywacke rocks) have the greatest potential for future water-supply schemes. (Woodard-USGS)
W71-03931

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
Transdanubian Water Authority, Szekesehervar (Hungary). Water Management.
G. Bukovszky, and I. Zsuffa.

In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 408-419, 1969. 12 p, 4 fig, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Unit hydrographs, *Flood forecasting, Hydrograph analysis, Mathematical studies, Hydraulics, Stream gages, Runoff forecasting.
Identifiers: Hungary.

Direct methods for establishing the unit hydrograph from any observed hyetograph and its corresponding hydrograph are described. The basic difficulty lies in establishing the relationship between total rainfall and runoff. Transition from the relation of precipitation amount--peak discharge at the outlet of the basin is executed in three successive phases: precipitation amount--effective rainfall, surface runoff--runoff concentration, channel flow--peak discharge at the outlet. The approximation is performed on the basis of direct measurements and hydraulic considerations or by way of experiments or by mathematical methods. (Knapp-USGS)
W71-03980

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
Akademiya Nauk Armyanskoi SSR, Erevan; and Ministry of Reclamation and Water Economy, Erevan (USSR). Water Problems and Hydrotechnics Research Inst.
I. V. Eguiazarov, and M. V. Tsovyan.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 396-403, 1969. 8 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Frequency analysis, *High water mark, *Flood forecasting, Hydrograph analysis, Peak discharge, Hydrographs.
Identifiers: *USSR.

The lack of necessary field information on storm runoff, particularly pertaining to small mountain rivers, does not permit determination of the design values of maximum discharges on the basis of direct observations for the majority of streams. This leads to the use of flood discharge determination by flood marks. The frequency of flood discharge is determined on the basis of frequency of effective precipitation, or by the period during which one more flood of the same intensity was observed; synthetic flood hydrographs are computed according to the isochrone method. Using the corrected values of runoff coefficients and the transition coefficients from the given frequency to the design frequency one can plot the design runoff hydrograph of the required frequency. (Knapp-USGS)
W71-03982

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
Grenoble Univ. (France).
M. Parde.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 379-390, 1969. 12 p.

Descriptors: *Rainfall-runoff relationships, *Peak discharge, *Flood forecasting, Data processing, Statistical methods, Runoff forecasting, Depth-area-duration analysis, Unit hydrographs, Hydrograph analysis.
Identifiers: Rainfall floods.

It is possible, by means of precipitation data, to determine the maximum discharges in past floods, or to control and, if necessary, to correct numerical data on floods. Estimation of the peak-flood discharge is recommended as a function of the total liquid volumes compatible with coefficients established for each basin for calculating flood runoff and duration. Interrelations of flood runoff, maximum discharge, and rainfall are duration. The same methods can be used for the estimation of floods caused by exceptional rainstorms. (Knapp-USGS)
W71-03983

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
Vsesoyuznyi Nauchno—Issledovatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR); and Khabarovsk Inst. of Railway Engineers (USSR).
I. L. Zimont, and U. G. Suprunov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 321-329, 1969. 9 p, 3 fig, 1 photo, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, Hydraulic similitude, Dimensional analysis, Model studies, Hydrograph analysis, Hydraulic models, Simulated rainfall.
Identifiers: Watershed models.

A description of experiments on flood formation in field and laboratory conditions is presented. On the basis of the theory of similitude and the dimensionality method, modelling conditions are suggested, which may be used for flood prediction on small basins. A method is suggested which allows plotting outline of the hydrograph for the experimental basin if data on precipitation are available. (Knapp-USGS)
W71-03988

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
P. F. Wishnevsky.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 483-492, 1969. 10 p, 1 fig.

Descriptors: *Rainfall-runoff relationships, *Depth-area-duration analysis, *Routing, *Runoff forecasting, Water yield, Rainfall intensity, Flood plains, Probability, Flood forecasting.
Identifiers: USSR.

Available observation records of Ukrainian rainfall and runoff were used to design a method of maximum flood runoff calculation. For the calculation of maximum discharges a formula is suggested, which considers basic components of the runoff formation mechanism, including the value and duration of water yield and time lag. L0cal specific features of basins are taken into consideration. The calculation parameters of the formula are worked out on the basis of observations available. Reduction of the maximum runoff is considered according to the time lag. For the calculation of flood runoff volumes, two types of relationship are worked out for mountain and plain territories. (Knapp-USGS)
W71-03991

THE WORLD OF WATER,
Minnesota Univ., Minneapolis. Water Resources Research Center.
William Clarence Walton.
New York, NY, Taplinger Publishing Company, 1970. 318 p, 3 fig, 25 plate, 42 ref.

Descriptors: *Water resources, *Reviews, *Earth (Planet), *Hydrologic cycle, *Hydrology, Surface waters, Groundwater, Atmosphere, Water properties, Precipitation (Atmospheric), Evapotranspiration, Meteorology, Climatology, Oceans, Curre (Water), Tides, Waves (Water), Temperatu Water chemistry, Soil moisture, Aquifers, Lak Swamps, Reservoirs, Streams, Flood contr Water supply, Sewage, Dams, Recreation, Wildli Water conservation, Planning, Manageme Synoptic analysis.

An attempt is made to present, in nontechnical la guage, a digest of facts to inform the intellige general reader about water and its relation to ev day life. The information presented has been lar ly abstracted from the references listed at the e of the book. The oceans, ice caps, glaciers, subs face reservoirs, lakes, swamps, surface reservoi streams, and atmosphere contain the earth's to water. The physical aspects of these subjects a reviewed in this book together with biologic recreational, wildlife, economic, legal, and soc aspects. Some of the measures taken by man develop and manage water resources and the effects of man's activities on the environment a discussed. The problem of water conservation stressed. (Woodard-USGS)
W71-04118

ISOTOPE HYDROLOGY, 1970.
International Atomic Energy Agency, Vien (Austria).

Proceedings Symposium of International Atom Energy Agency and UNESCO, Vienna, March 13, 1970: Vienna, International Atomic Ener Agency STI/PUB/255, 1970. 918 p.

Descriptors: *Tracers, *Radioactivity technique *Radioactive dating, *Radioisotope *Hydrogeology, Water balance, Sedimentatio Sedimentology, Conferences, Hydrology, Groun water movement, Surface waters, Estuarie Hydrologic cycle, International Hydrologic Decade.
Identifiers: *International Atomic Energy Agency

The Third Symposium on the Use of Isotopes i Hydrology, which took place in Vienna on 9-1 March 1970, was organized by the Internation Atomic Energy Agency in cooperation with th United Nations Educational, Scientific and Cu tural Organization. The development of isotop hydrology, which is a useful tool for practicin hydrologists, has an interdisciplinary history. Th early work was done by isotope specialists. As th various techniques evolved, hydrologists becam interested in its potential. At the symposium ther was a balance between these two types of worker which indicates that the research has develope into practical working methods. The determinatio of groundwater parameters for a growing popula tion, and the sedimentation of harbors and river are two of the major problems discussed at the sym posium. The 59 papers presented in 9 sessions: en vironmental isotopes in the water cycle; carbon-1 dating of groundwater; field use of environmenta isotope methods; tracer studies of surface waters sediment studies; borehole techniques and nuclea instruments; canal and reservoir leakage; computa tion; and new techniques in tracing and dating (See also W71-04134 thru W71-04142) (Knapp USGS)
W71-04133

DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
Atomic Energy of Canada Ltd., Chalk River (On tario). Chalk River Nuclear Labs.
R. M. Brown.
In: Isotope Hydrology, 1970, Proceedings Symposi um of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, In ternational Atomic Energy Agency STI/PUB/255, Paper No SM-129/1, p 3-21, 1970. 19 p, 12 fig, 3 tab, 9 ref.

Descriptors: *Deuterium, *Tritium, *Tracers, *Tracking techniques, *Synoptic analysis, Cli matology, Water sources, Weather patterns,

teorology, Precipitation (Atmospheric), rms, Streamflow, Lakes, Evapotranspiration, lout, Distribution patterns.
ntifiers: *Canada, *Hydrogen isotope distribu- (Canada).

e passage of bomb tritium through natural water ems in Canada has been followed since 1954. ently the distribution of deuterium in precipita- and surface waters has been studied. These give valuable information on the continental er cycle and the turnover characteristics of in- dual river basins. Tritium and deuterium con- trations vary inversely in natural waters. Low centrations of tritium and high concentrations euterium occur in coastal regions which receive first condensate from oceanic vapor. As the sture moves inland, it picks up more tritium the atmosphere and is depleted in deuterium referential condensation of HDO. This pattern articularly marked in northern and western ada where low temperatures and mountain bar- across the weather tracks from the Pacific ce the deuterium content of the limited unt of moisture reaching central Canada. In east, absence of mountain barriers across ther tracks from the Gulf of Mexico results in relatively high deuterium concentrations in hern Ontario and Quebec. Storm-to-storm uations in isotope content of precipitation at wa reflect a variability in the origin of ipitating moisture. Seasonal variation of triti- due to late spring feed-in from the strato- re, has been particularly prominent and regu- t Canadian latitudes. Declining annual peak centrations since 1963 indicate depletion of the ospheric reservoir with a half-time of 1.2 years. also W71-04133) (Knapp-USGS)
-04134

IATION OF THE TRITIUM AND OXYGEN- ONTENT IN PRECIPITATION AND SNOW- K IN A REPRESENTATIVE BASIN IN CHOSLOVAKIA,
national Atomic Energy Agency, Vienna stria); and Hydraulic Research Inst., Prague choslovakia).
ncer, J. Martinec, B. R. Payne, and C. K. Yen.
otope Hydrology, 1970, Proceedings Symposi- of International Atomic Energy Agency and SCO, Vienna, March 9-13, 1970: Vienna, In- tional Atomic Energy Agency STI/PUB/255, r No SM-129/3, p 23-42, 1970. 20 p, 13 fig, 6 6 ref.

riptors: *Tritium, *Oxygen, *Snowpacks, wmelt, *Tracers, Melt water, Precipitation ospheric), Altitude, Water balance, Heat et, Hydrologic budget, Evaporation, Melting, olation, Porous media, Runoff.
ifiers: *Oxygen isotopes, *Czechoslovakia.

tion of the tritium and oxygen-18 content of precipitation and the snowpack during the r of 1965-1966 and the following snowmelt n was studied in a small mountain basin in ern Czechoslovakia. A significant altitude ef- exists for oxygen-18 when the precipitation is n the solid form. Evolution of the isotopic osition of the snowpack reflects the move- of meltwater in the snowpack and its relation e thermal conditions in the snowpack. Early melt percolates through the snowpack without mixing with the snow matrix. At the middle e snowmelt period the meltwater mixes with ater in the lower layers during the percolation e water through the snowpack. A pseudo-al- e effect is observed in the snowpack due to the pearance of the isotopically light early winter from the lower altitudes which are subject to mittent melting during the winter months. also W71-04133) (Knapp-USGS)
-04135

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
H. Moser, and W. Stichler.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/4, p 43-57, 1970. 15 p, 11 fig, 2 tab, 7 ref.

Descriptors: *Deuterium, *Snowpacks, *Altitude, *Distribution patterns, Snowmelt, Melt water, Precipitation (Atmospheric), Water balance, Hydrologic budget, Evaporation, Melting, Runoff, Tracers, Rainfall.
Identifiers: *Switzerland, *Alps.

Measurements of the deuterium content of snow samples from different regions of the western and eastern Alps revealed a general difference between samples of fresh snow and pack snow. The deuterium content of fresh snow was found to decrease approximately linearly with increase in elevation. The variation was about -4 parts per thousand per 100 m rise in elevation, and the deuterium content corresponded to that measured for rain in Central Europe. Pack snow, on the other hand, showed an increase in deuterium content with rise in elevation which, for the samples examined, fell within about ..5 parts per thousand per 100 m rise in elevation. Natural snow samples were used to follow and interpret the variation with time of the deuterium content caused by the aging of the snow. In addition to the dependence of the deuterium content on elevation, the annual pattern of the deterium content of snow samples corresponds to the known curve for deuterium in precipitation. (See also W71-04133) (Knapp-USGS)
W71-04136

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik. Science Inst.
B. Arnason.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/5, p 59-71, 1970. 13 p, 6 fig, 1 tab, 17 ref.

Descriptors: *Deuterium, *Glaciers, *Regimen, *Melting, *Melt water, Ice, Cryology, Climatology, Hydrologic budget, Water balance, Radioactive dating, Movement, Paleoclimatology, Precipitation (Atmospheric), Altitude, Water sources.
Identifiers: *Iceland, *Iceland ice cap.

The annual variation of deuterium concentration in precipitation in Iceland is small. This makes it possible to estimate the mean annual deuterium concentration in the precipitation on Icelandic glaciers by collecting samples of the winter layer before the beginning of the melting season. Ice cores collected from several boreholes on the glaciers, ranging in depths up to more than 100 m, were analyzed for their deuterium content. Extensive homogenization, which takes place in the uppermost winter layer during summer thaws, may be ascribed to an isotope exchange between ice and water in temperate glaciers. In the autumn, the deuterium concentrations in ice and water approach isotopic equilibrium at least up to an altitude of 1300 m. The isotope ratio can therefore be used for estimating the runoff ratio. This ratio, together with measurements of the amount of retained precipitation in previous annual layers, gives the amount of total yearly precipitation on temperate glaciers. The results are in good agreement with available data obtained independently. At an altitude of 2000 m deuterium measurements show that the yearly precipitation is totally accumulated. Therefore, at this altitude the deuterium concentration of an ice core collected by drilling through the ice cap may reflect the past climatic changes as o-18 does on polar glaciers. Small variations in the mean annual temperature are reflected in variations of the deuterium concentration of the ice core. (See also W71-04133) (Knapp-USGS)
W71-04137

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
Atomic Energy Research Establishment, Wantage (England). Research Lab.; Water Resources Board, Reading (England); and Hydrological Research Unit, Wallingford (England).
D. B. Smith, P. L. Wearn, H. J. Richards, and P. C. Rowe.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/6, p 73-87, 1970. 15 p, 6 fig, 7 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Recharge, *Tracers, *Tritium, Unsaturated flow, Percolation, Limestones, Clays, Porous media, Tracking techniques, Model studies, Rainfall-runoff relationships, Surface-groundwater relationships, Distribution patterns, Rainfall, Precipitation (Atmospheric), Water balance, Evapotranspiration.
Identifiers: *England, Chalk.

Measurement of the natural tritium concentration in groundwater samples from a vertical profile in the unsaturated zone of a formation provides information on the downward movement of water in the strata. The tritium profiles are evaluated in terms of hydrological models to examine the mechanism of water recharge. Tritium measurements in the Chalk of England show that downward movement is principally by intergranular seepage with a smaller component of movement through crack systems. Two hydrological models offer alternative interpretation of the water recharge. Tritium measurements in a low-permeability clay show the downward movement of water by intergranular seepage and indicate that recharge occurs by replenishment of the summer soil moisture deficit by autumn rainfall. (See also W71-04133) (Knapp-USGS)
W71-04138

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
Liliane Merlivat.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/7, p 89-107, 1970. 19 p, 9 fig, 2 tab, 14 ref.

Descriptors: *Water balance, *Lakes, *Deuterium, *Oxygen, Limnology, Tracers, Tracking techniques, Evaporation, Precipitation (Atmospheric), Recharge, Discharge (Water), Water sources, Water circulation, Diffusion, Mixing, Model studies, Hydraulic models, Mass transfer, Advection.
Identifiers: France, *Oxygen isotopes.

Water in a reservoir which is subjected to relatively strong evaporation has an O-18 content different from that of its recharge water. The processes responsible for the modification of the isotopic composition of the water in a reservoir in relation to its recharge water are summarized. In the proposed O-18 diagram both deuterium and O-18 give the same information and measuring both should indicate the accuracy of the method. The measurable quantity is the ratio between evapora-

tion and recharge. The numerical value of this ratio closely depends on the water vapor transport equation used in the diagram, in particular the relation between the evaporation rate and the diffusion coefficient. Measurements of evaporation in a tunnel under laminar flow conditions are described in some detail. Under these flow conditions the mass transport equations are well known and can be solved numerically by computers. The evaporation rate and the related isotope effects in given experimental conditions can then be calculated exactly. The extent to which the results obtained with deuterium and oxygen-18 depend on the hypotheses that have to be made in the absence of complete knowledge of all the parameters. (See also W71-04133) (Knapp-USGS)
W71-04139

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
Weizmann Inst. of Science, Rehovoth (Israel).
J. R. Gat.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/8, p 109-127, 1970. 19 p, 11 fig, 21 ref.

Descriptors: *Water balance, *Lakes, *Deuterium, *Oxygen, Limnology, Tracers, Tracking techniques, Evaporation, Precipitation (Atmospheric), Recharge, Discharge (Water), Water sources, Water circulation, Diffusion, Mixing, Mass transfer, Advection.
Identifiers: *Israel, *Lake Tiberias (Israel).

The stable isotope composition and tritium content of Lake Tiberias (Sea of Galilee or Lake Kinneret) has been monitored for over ten years. The O-18 concentration in the upper water mass undergoes a yearly cycle of average amplitude of 0.5 parts per thousand. The hypolimnion follows the change at much reduced amplitude. Deuterium concentrations change in a similar manner with 5.3 times the variation of O-18. The mean yearly isotope composition shifts up to 1.5 parts per thousand for O-18 as a result of hydrological imbalances between water gain and losses. Detailed balance calculations based on available hydrological and climatic data were made and their reliability discussed. In particular, the effect of vertical stratification and the magnitude of separation coefficients were explored. It is shown that controlled evaporation experiments can give more pertinent data on the exchange fluxes of both tritium and stable isotopes than calculations based on time-averaged humidity data. From such evaporation experiments using thermostatted pans, effective isotope fractionation factors for O-18 and deuterium evaporation were determined and shown to depend on the degree of atmospheric turbulence and the stability in the surface layer. (See also W71-04133) (Knapp-USGS)
W71-04140

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA: INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
Heidelberg Univ. (West Germany). Physikalisches Institut (II).
U. Zimmermann, and D. H. Ehhalt.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/9, p 129-138, 1970. 10 p, 2 fig, 2 tab, 13 ref.

Descriptors: *Water balance, *Lakes, *Deuterium, *Oxygen, Limnology, Tracers, Tracking techniques, Evaporation, Evapotranspiration, Precipitation (Atmospheric), Recharge, Discharge (Water), Water sources, Water circulation, Diffusion, Mixing.
Identifiers: *Austria, *Lake Neusiedl (Austria).

The isotopic composition of a lake depends on its water balance; therefore the balance equations of stable isotopes provide information for evaluating the water balance. The main source of error is that of the isotope content of the moisture evaporating from the lake. Errors in the isotope content of the lake water and its variation with time are also important. Stable isotope measurements were used to study the water balance of Lake Neusiedl near Vienna. Since 1965 the isotope content of rain, river water, groundwater, and lake water have been determined. Water vapor has been collected continuously since March 1968. Even where all isotope data are determined with good accuracy, it can be difficult to determine the evaporation rate of a lake with an accuracy better than 50%. (See also W71-04133) (Knapp-USGS)
W71-04141

PERCH LAKE EVAPORATION STUDY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
P. J. Barry, and W. F. Merritt.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/10, p 139-151, 1970. 13 p, 3 fig, 1 tab, 2 ref.

Descriptors: *Lakes, *Water balance, *Evaporation, *Tracers, *Tritium, Groundwater movement, Surface-groundwater relationships, Hydrogeology, Trace elements, Energy budget.
Identifiers: *Canada, *Perch Lake (Ontario).

The Perch Lake project used radioactive tracers in the study of all aspects of the hydrological cycle in a small, well-defined basin. The use of tritiated water vapor for the study of evaporation mechanisms in a natural setting is believed to be unique. Other studies include the determination of the water, tritiated water, energy and trace element budgets of the lake of which the first three complement the use of tritiated water vapor to study basic evaporation mechanisms. Radioactive tracers have been used particularly for estimating the groundwater components of the water and tritium budgets. Groundwater flows predicted by the use of conventional hydrological techniques as well as various new flow models are being compared with the results obtained using radioactive tracers. Perch Lake is a small (0.45 sq km) lake on the property of Atomic Energy of Canada Limited at Chalk River, Ontario. It contains about 400 pCi/ml of tritium coming from the liquid disposal area operated by the Chalk River Nuclear Laboratories. Waste solutions containing several thousands of curies of tritium are discharged annually into pits in the ground and then move both in the surface and groundwaters of Perch Lake swamp into the lake. One small creek provides the only outlet for surface water for the whole basin. (See also W71-04133) (Knapp-USGS)
W71-04142

A SIMPLE CASCADE WATERSHED MODEL,
California Univ., Davis. Dept. of Water Science and Engineering.
Jaime Amorocho, and Gary Leroy Guymon.
California University Water Resources Center Report, August 1969. 16 p, 4 fig, 2 tab, 8 ref. OWRR Project B-005-CAL (3).

Descriptors: *Mathematical models, *Simulation analysis, *Rainfall-runoff relationships, Runoff forecasting, Synthetic hydrology, Groundwater movement, Surface-groundwater relationships, Evaporation, Routing.
Identifiers: *Cascade watershed-model.

The applicability of a simple cascade model to a real watershed is examined; the model is composed of a soil water submodel and a linear streamflow routing model cascaded together. The model roughly represents hourly instantaneous watershed outflows. The errors associated with the model can be minimized by further adjustments to the mod The soil water submodel consists of a watersh divisible into a variable number of 3-dimensio zones occupying some unknown space in watershed. The zones have an ordered effect on evapotranspiration and runoff process. One rain station is used as an index of hourly input to prototype watershed and daily pan evaporati data is used to estimate hourly evaporation. Fr these data, the soil water submodel estima hourly rainfall excess. (Knapp-USGS)
W71-04181

SECULAR VARIATION OF ARIDITY IN TH WORLD,
Tokyo Metropolitan Univ. (Japan). Faculty Science.
Yoshinari Ambe.
Japanese Journal of Geology and Geography, V 38, No 1, p 43-61, 1967. 10 fig, 2 tab, 21 ref.

Descriptors: *Arid lands, *Climatic da *Precipitation (Atmospheric), *Evaporation, *C matic zones, Statistical methods, Temperature, C matology, Seasonal, Data collections, Deser Variability, Correlation analysis, Average, Forei countries, United States, Geographical region Mexico, Air circulation, Fluctuation, Distributi patterns, Maps.
Identifiers: *Potential evapotranspiratio *Thorthwaite's formula, *Climatic classificatio *Global studies, Continents, Hemispheres, Afric Asia, Australia, South America.

An attempt is made to understand recent climati variations from the standpoint of spatial variatio of arid climatic regions. Since variations in arid cl mates seem to reflect secular variations of gener circulation, it is important to determine whethe recent world climatic variations take place on global scale, on a hemispheric unit or on a co tinental scale. Monthly aridity is defined on th basis of the precipitation (P)/evaporation (E) rati which corresponds to Thornthwaite's P-E ratio. the ratio is less than 1 for any month, it is termed 'dry month'. An arid region is defined as any regio in which every month is a dry month. Usin precipitation and temperature data from a numbe of years over the past half century, the P-E rati was calculated for each month of the year and fo all continents except those latitudinal region where mean monthly temperatures fell below -1 deg. C. All arid region boundaries were the defined, and their variation over time was deter mined. Climatic conditions forming arid region varied from year to year, and the variation was al ways greater on the east side than the west. How ever, in the period 1931-1960 no remarkable changes with a definite tendency were found. Frequency distributions had generally large vari ances, indicating complicated arid zone formation factors. In yearly fluctuations hemispheric scale variations predominated over those on a global scale and relationships between climatic variations in the northern and southern hemispheres were in significant. The large variability in arid region patterns shows the characteristics of climate itself, reflecting conditions of atmospheric circulation. (Casey-Arizona)
W71-04288

2B. Precipitation

CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
North American Weather Consultants, Pasadena, Calif.
For primary bibliographic entry see Field 03B.
W71-03903

WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
National Weather Service, Silver Spring, Md. Office of Hydrology.

ıter Supply Outlook for the Western United
ıtes, Department Commerce Publication, Vol
No 1, January 1, 1971. 16 p, 3 map, 10 tab.

scriptors: *Water supply, *Runoff forecasting,
ydrologic data, *Geographical regions, *United
tes, Probability, Precipitation (Atmospheric),
tistical methods, Hydrology, Meteorological
a, Average flow, Streamflow, Water yield,
ervoir storage, Flood forecasting, Surface
ers.
ntifiers: *Runoff forecasting (Western United
tes), Maximum runoff, Minimum runoff,
rage runoff.

cipitation and snowfall accumulation of known
bability as determined by analysis of past
ords are utilized in the preparation of probabili-
runoff forecasts. The forecasts include an
luation of the standard error of the prediction
del. The forecasts are presented at three levels
obability as follows: 1. Most Probable - That
off which is expected to occur if precipitation
equent to the date of forecast is median. 2.
sonable maximum - That runoff which is ex-
ed to occur if precipitation subsequent to the
of forecast is equal to the amount which is ex-
ded on the average once in ten years. 3.
sonable Minimum - That runoff which is ex-
ed to occur if precipitation subsequent to the
of forecasting is equal to the amount which is
eeded on the average nine out of ten years. The
t Probable forecast for a forecast period is
n in thousands of acre-feet and in percent of
15-year average. The Reasonable Maximum
Reasonable Minimum forecasts are shown in a
lar manner. The 15-year average flow for the
cast period for 1953 through 1967 and other
ed data are included. (Woodard-USGS)
-03927

CALCULATION OF RAINFALL FROM A RRICANE,
sh Meteorological Office, Bracknell (En-
d).
ngleton, and N. C. Helliwell.
loods and Their Computation, Vol 1, Interna-
l Association of Scientific Hydrology Publica-
No 84 (Unesco-WMO), p 450-461, 1969. 12
ig, 5 tab, 7 ref.

criptors: *Rainfall, *Hurricanes, *Estimating,
bable maximum precipitation, *Probability,
stical methods, Weather data, Precipitation in-
ty, Rainfall disposition, Model studies, Mathe-
cal models, Statistical models.
tifiers: Jamaica, Hurricane rainfall.

imum values of point and areal rainfall were
puted for a catchment area in Jamaica using an
rical model of a hurricane. The hurricane
el used was that derived by the Hydrologic Ser-
Division, United States Weather Bureau. The
s resulting from the computation were com-
d to those obtained using, firstly, a conven-
l probable maximum precipitation approach
ving maximization, and, secondly, the statisti-
pproach of Hershfield. Good agreement was
ved between the three techniques. The
od enabled computation of the temporal
tion of rainfall during the passage of the
retical hurricane and also of the effects of
tions of speed of movement and in the
nce of the hurricane from the catchment. (K-
-USGS)
-03993

ORE RIGOROUS EXPRESSION FOR THE E OF DROPLET GROWTH,
spheric Sciences Lab., White Sands Missile
e, N. Mex.
rimary bibliographic entry see Field 03B.
-04005

TED STATES COAST GUARD OCEANO-PHIC SENSOR STUDY. VOLUME I. TE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04009

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04010

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04011

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04012

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04013

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04014

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
W. C. Huber.
Available from NTIS as PB-197 267, $3.00 in paper copy, $0.95 in microfiche. Florida Water Resources Research Center Publication No 10, October, 1970. 128 p, 1 tab, 12 fig, 25 ref, 2 append. OWRR Project A-014-FLA (1).

Descriptors: *Solar radiation, *Radiation, *Energy budget, *Heat budget, Temperature distribution, Hydrologic cycle, Thermal stratification, *Temperature, Lakes, Reservoirs, Thermal radiation, Geothermal studies, Heat balance, Florida, Humidity, Cloud cover, Meteorological data.
Identifiers: Temperature change, Thermal change, Atmospheric radiation, Shortwave radiation, Newman's Lake (Fla), Radiation data.

Evaluation of terms in the energy budget is an integral part of the prediction of thermal changes in natural water bodies. These lakes, reservoirs, streams, and tidal waters receive heat from shortwave solar radiation, longwave atmospheric radiation, and advectively from surface water inflows. The net advective heat flux if often zero, in which case the radiation components are the dominant causes of temperature changes. Predictive methods for the two radiation components have been developed as a function of meteorological parameters alone, (e.g. temperature, humidity, cloudiness, opaqueness). These predictive methods can be used in areas where there are no records of radiation measurements since the required meteorological variables are commonly measured at weather stations and airports. A better predictive equation was found for shortwave radiation than for longwave radiation, due possibly to local climatic conditions and possible errors in portions of the longwave radiation measurements. Use of the shortwave equations in evaluating temporal temperature changes in a Florida lake resulted in good agreement with measured values. A tabulation of 148 days of hourly radiation and meteorological values is included in the report.
W71-04020

OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
New Mexico State Univ., University Park. Engineering Experiment Station.
For primary bibliographic entry see Field 06A.
W71-04033

ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
Economic Commission for Asia and the Far East (UN), New York.

Water Resources Journal, United Nations Economic Commission for Asia and the Far East (ECAFE), p 1-11, June 1970. 11 p, 5 fig, 3 tab.

Descriptors: *Flood forecasting, *Frequency analysis, *Design flood, *Monsoons, *Typhoons, Tropical regions, Wet seasons, Rainfall-runoff relationships, Frequency, Design storm, Warning systems, Peak discharge.
Identifiers: *ECAFE, *Asia.

Of all the factors influencing floods in the ECAFE region, monsoons play the most important role. Design flood envelope curves were determined by fitting a smooth curve through the three outermost points of plotted data. These three controlling points were also used to determine the envelope curve equations for each subregion. In general, the envelope-frequency relations derived in this paper are satisfactory for use by water resources engineers in planning the development of ungaged rivers in the ECAFE region, particularly where data are nonexistent or are inadequate. The most reliable envelopes are those with return periods of 50 years. The 100-year curves are fairly reliable. (Knapp-USGS)
W71-04117

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 07A.
W71-04122

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
Aston Univ., Birmingham (England).
For primary bibliographic entry see Field 07B.
W71-04123

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
Meteorological Office, Poona (India).
E. V. Chelam.
In: Forecasting of Heavy Rains and Floods, Proceedings Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 11-20, 1970. 10 p.

Descriptors: *Weather forecasting, *Synoptic analysis, *Monsoons, *Precipitation (Atmospheric), Atmospheric physics, River forecasting, Wet seasons, Weather patterns, Cloud physics, Meteorology, Floods, Flood forecasting, Fronts (Atmospheric).
Identifiers: *ECAFE, *Asia.

Forecasting of heavy rainfall, with particular reference to quantitative predictions, and with a bearing on the ECAFE region, is discussed. Heavy precipitation is caused by vertical ascent of saturated air. Techniques for assessing and forecasting moisture content and vertical velocity are described, using the concept of precipitable water and the forced ascent of air at an orographic barrier or a dynamic barrier (for example at a frontal surface) or due to horizontal mass convergence. Physical methods of quantitative estimates, statistical techniques employing scatter diagrams, and numerical methods which involve solution of the vertical velocity equation with the aid of an electronic computer are described with special attention given to the applicability of these techniques to the ECAFE region. The synoptic systems which gave heavy rainfall in the region such as depressions, typhoons, convergence zones, mountain waves, etc., are described, and case studies involving applications of the techniques described earlier to these systems are presented. (Knapp-USGS)
W71-04152

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
Meteorological Office, Poona (India).
E. V. Chelam.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 21-25, 1970. 5 p, 36 ref.

Descriptors: *Weather forecasting, *Synoptic analysis, *Monsoons, *Precipitation (Atmospheric), Atmospheric physics, River forecasting, Wet seasons, Weather patterns, Cloud physics, Meteorology, Floods, Flood forecasting, Fronts (Atmospheric).
Identifiers: *ECAFE, *Asia.

Formulas used to estimate quantitatively the magnitude of likely rainfall over an area from a vertically ascending mass of saturated air, are reviewed. The basic assumption in many of these attempts is either to ignore the horizontal wind field or treat it as nondivergent. Such an assumption is open to serious objections considering the fact that the observed wind field is seldom nondivergent; moreover, no appreciable vertical velocities (which alone could lead to rainfall) should be expected in a nondivergent wind field. It can be shown that a formula which is substantially of the form as developed by Fulks and Showalter can be derived without recourse to any assumptions about nondivergence of the wind field. The treatment can be easily extended for a case where the air is not fully saturated. In this case, part of the moisture flowing in will go to saturate the moist air and the rest of the excess flow will result in precipitation. The rainfall amounts will then be diminished to the extent of the difference between the unsaturated content of humidity in the air and its saturated value. (Knapp-USGS)
W71-04153

DETECTION OF PRECIPITATION BY RADAR,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
For primary bibliographic entry see Field 07B.
W71-04154

ANALYSIS OF RAINFALL OVER A SMALL AREA,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 44-53, 1970. 10 p, 6 fig, 5 ref.

Descriptors: *Rain gages, *Network design, *Statistical methods, *Rainfall disposition, *Distribution patterns, Reviews, Precipitation intensity, Depth-area-duration analysis, Precipitation (Atmospheric).
Identifiers: *ECAFE, *Asia.

Rainfall in the tropics and subtropics may occur in the form of scattered showers or widespread rain. Forecasts of rain usually depend on the detection of extensive zones of convergence associated with some types of disturbances and on the assumption that the rain is general. The verification of rain occurrence is difficult if the purpose is to distinguish between days on which rain is recorded and those on which no rain occurs. Obviously, a single point of observation over a large area is insufficient. Methods used to obtain an accurate appraisal of the distribution of rainfall and to determine the representativeness of an individual randomly placed rain gage are reviewed. (Knapp-USGS)
W71-04155

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 54-72, 1970. 19 p, 10 fig, 1 tab, 22 ref.

Descriptors: *Synoptic analysis, *Monsoons, Rainfall, Precipitation (Atmospheric), Atmospheric physics, Climatology, Frequency, Frequency analysis, Weather forecasting, Meteorology, Regions, Weather forecasting, Flood forecasting.
Identifiers: *ECAFE, *Asia.

Heavy rainfall over the various regions in Southeast Asia is generally associated with tropical cyclones; monsoon depressions and cyclonic vortices; quasi-stationary or slow-moving fronts, troughs and convergence zones; and easterly or westerly moving troughs or vortices in the upper levels. The primary feature of these disturbances is a relatively extensive area of convergence where local heavy rain, which may be in the form of showers, is embedded in a larger area of 'background' rainfall. It is generally known that rainfall is usually enhanced by the simultaneous presence of surface and upper-air disturbances. Studies in Hong Kong reveal that extreme rains are mostly due to intense convective cells embedded in troughs and in tropical cyclones, so that both types form the controlling systems for this region. (Knapp-USGS)
W71-04156

ANALYSIS OF MESOSCALE SYSTEMS,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 73-90, 1970. 18 p, 8 fig, 1 tab, 13ref.

Descriptors: *Weather forecasting, *Meteorology, *Radar, Synoptic analysis, Weather patterns, Monsoons, Precipitation (Atmospheric), Atmospheric physics, Wet seasons, Floods, Fronts (Atmospheric).
Identifiers: *Mesoscale weather-systems, *ECAFE, *Asia.

The importance of mesoscale features has long been recognized in synoptic studies of cold fronts and thunderstorms. These systems can be identified and followed as entities with good continuity from hour to hour and are associated with most of the severe weather experienced in Southeast Asia. The characteristics of mesosystems are different from those of synoptic systems. In mesosystems, life time is of the order of a few hours and the height-diameter ratio is large. Their flow pattern is characterized by departures from hydrostatic equilibrium. For small-size convective systems, the effect of Coriolis force is relatively unimportant and the feeble entrainment rate would also allow the conventional parcel method to be used to estimate instability, but condensation and evaporation are important from the energy-transfer point of view. In Hong Kong, short-period forecasts of rainfall amount are prepared by analyzing the shape, movement and, whenever possible, the decay characteristics of storm cells as revealed by a 10-cm radar. The data are fed into a small desk-top computer and the expected rainfall at a point for various durations can be computed in a few minutes. (Knapp-USGS)
W71-04157

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 91-112, 1970. 12 p, 2 fig, 5 tab, 11 ref.

Descriptors: *Typhoons, *Tropical cyclones, *Weather forecasting, Flood forecasting, Atmospheric physics, Forecasting, Synoptic analysis, Weather patterns, Meteorology, Storms.
Identifiers: *Typhoon forecasting, *ECAFE, *Asia.

The development of a reliable system by which typhoon forecasts can be issued early enough for people to take the necessary measures to protect their lives and property is a serious necessity in Southeast Asia and the Tropical Pacific. To satisfy operational needs, the forecast method must provide a good average level of accuracy and should not be unduly dependent on fine detail in the analysis of the basic data. Recent objective techniques for forecasting typhoon movement produce satisfactory results. During 1961, the Hong Kong Royal Observatory initiated a program to test the operational value of several of these techniques. On the whole, the mean errors given by the Veigas-Miller, Tse and persistence climatology methods were found to be less than those given by the nonobjective forecasts of the Observatory. The results given by the persistence climatology method were particularly encouraging. An analysis of the errors associated with individual storms confirmed the previous finding that no method was consistently better for all storms and no method was consistently better for any one storm with a life period of 3 days or more. (Knapp-USGS)
W71-04158

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
Japan Meteorological Agency, Tokyo. Forecast Section.
For primary bibliographic entry see Field 02E.
W71-04159

LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
Bureau of Meteorology, Melbourne (Australia). Service Div.
A. F. Rainbird.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23,

3, Kuala Lumpur, Malaysia, published by ld Meteorological Organization, Geneva, p 182, 1970. 8 p, 5 ref.

criptors: *Weather forecasting, *Rainfall, At-pheric physics, Synoptic analysis, Statistical nods, Cloud physics, Wet seasons, Weather erns, Meteorology, Precipitation (Atmospher-Climatology.
tifiers: *ECAFE, *Asia.

d-scale (synoptic scale) and medium-scale so-scale) processes which lead to heavy rain-are reviewed. Individual rainstorms contribute ly differing amounts of rain. However, the per-age of annual precipitation total supplied by and small storms appears to be fairly constant pective of location of a river basin. Approxi-ly half of the annual precipitation is con-ted by about one-quarter of the storms ex-enced over a basin. Methods in use for making titative forecasts of precipitation amount may lassified as: subjective forecasting techniques; stical techniques; and techniques involving ion of the dynamical equations describing at-pheric motions and the precipitation process. also W71-04161 thru W71-04163) (Knapp-S)
-04160

TURE 2 - PROBABLE MAXIMUM CIPITATION (PMP) ESTIMATION,
eau of Meteorology, Melbourne (Australia). ice Div.
. Rainbird.
Forecasting of Heavy Rains and Floods, Proc t Seminar of Regional Associations 2 and 5 of ld Meteorological Organization, Nov 11-23, 3, Kuala Lumpur, Malaysia, published by ld Meteorological Organization, Geneva, p 190, 1970. 8 p, 10 ref.

criptors: *Probable maximum precipitation, sign flood, Estimating, Statistical methods, del studies, Data collections, Maximum proba-flood, Weather data, Weather forecasting, ud physics.
tifiers: *ECAFE, *Asia.

bable maximum precipitation for a river basin be estimated by use of: climatological data; m models; or storm maximization and trans-tion techniques. Probable maximum precipita-is defined as the largest rainfall that we esti-e nature can produce in a specified time over a ified river basin. Time and areal distributions MP must also be estimated to allow conversion ainfall depth to flood discharge. Subjective ement and experience must be invoked in esti-ing PMP. No set of objective rules can be ified which, if followed carefully, will lead to a ue answer. The aim of the review paper is efore to indicate the principles underlying PMP nation. A routine program of storm rainfall analysis is strongly recommended. Such a pro-n will provide an invaluable store of analyzed for future needs in many fields. (See also 1-04160) (Knapp-USGS)
1-04161

CTURE 3 - STORM MAXIMIZATION CHNIQUES IN EQUATORIAL/TROPICAL GIONS,
eau of Meteorology, Melbourne (Australia). vice Div.
. Rainbird.
Forecasting of Heavy Rains and Floods, Proc nt Seminar of Regional Associations 2 and 5 of rld Meteorological Organization, Nov 11-23, 8, Kuala Lumpur, Malaysia, published by rld Meteorological Organization, Geneva, p -196, 1970. 6 p, 5 ref.

criptors: *Probable maximum precipitation, sign flood, Estimating, Statistical methods, del studies, Data collections, Maximum proba-flood, Weather data, Weather forecasting, ud physics.
Identifiers: *ECAFE, *Asia.

The storm moisture adjustment technique has been used extensively in extratropical regions to maximize observed storm rainfalls. However, it is recognized that this technique is not of equal value in all climatic regions of the world, and there are strong limitations to its use in the equatorial/tropical regions. In these regions, very high atmospheric moisture is present for most or all of the time in the rainy season. There is no apparent direct relationship between the minor day-to-day fluctuations observed in atmospheric moisture, and the occurrence of 'normal' wet season rains on one day, and of very heavy rain on another. Two maximization studies for tropical areas are described to illustrate approaches to the special problems posed by these regions. Subjective judgement must be exercised at a number of stages when estimating PMP for a river basin by storm maximization and transposition techniques. Deficiencies in quality or quantity of historical data and uncertainty in applying any of the procedures must be compensated by increased safety margins. (See also W71-04160) (Knapp-USGS)
W71-04162

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
Bureau of Meteorology, Melbourne (Australia). Service Div.
A. F. Rainbird.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 197-205, 1970. 9 p, 9 ref.

Descriptors: *Probable maximum precipitation, *Design flood, Estimating, Statistical methods, Model studies, Data collections, Maximum probable flood, Weather data, Weather forecasting, Cloud physics.
Identifiers: *ECAFE, *Asia.

Methods of estimating probable maximum precipitation PMP involve a high degree of subjective judgment and decision. More objective methods of estimating PMP and maximum floods are desirable. The use of techniques in mathematical statistics for these purposes is reviewed. Because statistical methods involve mathematical computation and have the appearance of objectivity, there is a danger that greater confidence may be given to the end results than is really justified. Use of a statistical technique to estimate PMP or a maximum flood involves the assumption that the particular technique used is appropriate and relevant for those purposes. This assumption is usually also based on judgment rather than on mathematical proof. The various estimates derived by different approaches will at least indicate the range of possibilities and will help point to cases where inherent uncertainties justify a conservative approach in project design. (See also W71-04160) (Knapp-USGS)
W71-04163

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
Burma Meteorological Dept., Rangoon.
Htay Aung.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia; published by World Meteorological Organization, Geneva, p 213-220, 1970. 8 p, 5 fig.

Descriptors: *Floods, *Rainfall-runoff relationships, *Flash floods, Antecedent precipitation, Rainfall intensity, Storms, Cloudbursts, Tropical regions, Tropical cyclones.
Identifiers: *ECAFE, *Burma.

Heavy rains which occurred on October 23-24, 1967 caused a flash flood in the Pakokku and Monywa districts of central Burma. The flash flood and the severe cyclonic storm responsible for the heavy rain are described. Heavy rainfall started on the evening of October 23 and stopped on the morning of October 24. The flash flood thus started on the night of the 23rd and was over on the morning of October 24. The occurrence of the flash flood during the night and the strong winds due to the land depression was unfavorable for evacuation of the inhabitants of Pakokku and Monywa districts. Most of the flash floods in Burma are associated with heavy rainfall. Forecasting of flash floods depends on forecasting of heavy rainfall, which in turn depends on the movement of the storm. (Knapp-USGS)
W71-04164

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
Burma Meteorological Dept., Rangoon.
For primary bibliographic entry see Field 02E.
W71-04165

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
Japan Meteorological Agency, Tokyo.
Yonejiro Yamagishi.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia; published by World Meteorological Organization, Geneva, p 243-252, 1970. 10 p, 3 fig.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Japan, *ECAFE, *Jet streams.

Japan is situated close to the east coast of the Asiatic Continent and is in one of the rainiest areas in the middle latitude. Typhoons attacking Japan from early summer to late autumn bring with them a great quantity of tropical warm moist air, and usually give rise to heavy rainfalls. In early summer, a front remains near and over Japan, while the southwesterly monsoon carries warm moist air from South China to Japan. Almost every year heavy rainfall occurs near this front, particularly in Western Japan. Some characteristic features of heavy rainfall in Japan are discussed in relation to the jet stream pattern. (Knapp-USGS)
W71-04166

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
Drainage and Irrigation Dept., Kuala Lumpur (Malaysia). Research Station.
Tan Hoe Tim.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 253-258, 1970. 6 p.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Malaysia, *ECAFE.

The 1967 floods occurring in the Malaysian east coast States of Kelantan and Trengganu as well as in the State of Perak claimed many victims, and total losses sustained were estimated at some US $12.5 million. A brief description of the storm was given, together with an account of the existing

flood warning system. The seasonal rainfall patterns are associated with two distinct surface winds, namely the N-E and the S-W monsoons - from November to March, and May to September respectively. The most frequent type of monsoon rain is preceeded by strong easterly or northeasterly surface winds in the South China Sea. If it is reinforced by the presence of other low-level atmospheric disturbances in the form of either shallow vortices or strong horizontal winds, then heavy storms covering a large area for an appreciable duration are likely to occur. (Knapp-USGS)
W71-04167

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
Pakistan Meteorological Dept., Karachi. Central Secretariat.
M. S. Huq.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Orgaization, Geneva, p 259-266, 1970. 8 p, 3 fig, 5 ref.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Pakistan, *ECAFE.

Quantitative precipitation forecasting over an area under favorable synoptic conditions is necessary for flood forecasting. Synoptic features of weather systems associated with heavy rainfall over Pakistan during strong southwest monsoon, easterly waves, pre-monsoon, monsoon and post-monsoon depression, western disturbances, and storms are described. Seasonal floods occur over East Pakistan and northern parts of West Pakistan during the southwest monsoon season, when heavy rainfall takes place for days. Flash floods over the northeastern part of West Pakistan during winter result from moderately heavy to heavy rains caused by passage of active western disturbances. Over southern parts of east Pakistan during the period May to October they result from heavy to very heavy rains caused by travel of tropical depression storms over or near the area. Tidal waves occur in East Pakistan when tropical storms cross the coast at the time of high tide. All the formulas reviewed for quantitative precipitation forecasting require use of high-speed electronic computing machines for computation of rainfall. (Knapp-USGS)
W71-04168

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
Regional Meteorological Center, Lahore (Pakistan).
Sufi M. Moazzam.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 267-281, 1970. 15 p, 10 fig, 1 map.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Pakistan, *ECAFE.

Westerly low-pressure waves, locally known as western disturbances, cause winter rainfall over West Pakistan. Moderately heavy rainfall occurs occasionally due to active low-pressure waves. The summer monsoon is mainly responsible for rainfall over West Pakistan and over the upper catchment areas of the rivers of the Indus Basin. During the monsoon season, depressions and storms developing over the Bay of Bengal and then moving towards West Pakistan cause heavy rainfall over the upper catchment of the rivers and sometimes over the plains as well. Floods are mainly due to this heavy rainfall. Moderately heavy to heavy rainfall in winter over the Indus and Jhelum catchment areas can also cause medium or high floods. Rainfall predictions are made empirically with upper-air and normal seasonal precipitation maps. Rainfall-runoff relationships were evolved for flood forecasting purpose. (Knapp-USGS)
W71-04169

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
Singapore Meteorological Service.
T. L. Gan.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 283-289, 1970. 7 p, 3 fig, 9 ref.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Malaysia, *ECAFE.

In January 1967 there was catastrophic flooding on the east coast of North Malaya, and in February 1967 there was flooding in South Malaya. By contrast January and February 1968 were dry. The well-developed troughs in the sub-tropical jetstream which extended to equatorial latitudes over West Malaysia in January - February 1968, were mainly responsible for the dry weather over Singapore and the east coast of West Malaysia during this period. Heavy rainfall in January - February 1967, was associated with vortices in the inter-tropical convergence zone with a broad deep easterly current to the north. The vortex of January 5, 1967, was associated with a strong surge of the trades and a cold surge from Siberia (indicated by high and increasing pressure over China). It is likely that these two factors intensified the vortex and produced the abnormally heavy rainfall from January 5-6, 1967. (Knapp-USGS)
W71-04170

THE CLIMATE OF INTERIOR OMAN,
Anti-Locust Research Centre, London (England).
D. E. Pedgley.
Meteorological Magazine, Vol 99, No 1171, p 29-37, February 1970. 2 fig, 3 tab, 17 ref.

Descriptors: *Arid lands, *Monsoons, *Precipitation (Atmospheric), *Climatic data, *Winds, Seasonal, Climatology, Meteorology, Turbulence, Temperature, Humidity, Convection, Tropical regions, Tropical cyclones, Advection, Flow profiles.
Identifiers: *Oman, *Intertropical convergence zone, *Oman convergence zone.

Until recently, data on the climate of the interior of Oman and the Empty quarter of Arabia in general, have been lacking. Now, oil company exploration camps are keeping records and some data, though inadequate, is available. Records from Fahud indicate relative humidity maxima occurring January and February and a secondary maximum in August and September. Mean monthly temperature maxima show a seasonal trend, with January the coolest and June the hottest, while July to September were each cooler than expectations from trends in the other months. This is associated with monsoonal blowing from the Arabian Sea during those months. A 7-year rainfall record is adequate, but indicates an annual total of 30 mm, most of which falls from March to May with scanty falls from July to September. These records are similar to those from Midway, Dhofar and Nizwa, although Nizwa, at the eastern base of the Hajar Mountains, experiences somewhat more July to September rainfall. Over the Hajars, annual totals reach 150 mm. The southerly monsoon (July to September), peaks in July and is about 1 km deep. For the rest of the year, dry north-westerlies dominate the interior and when they meet either easterlies (November to January) or Southerlies (February to June, October), an Oman convergence zone is indicated. From July to September this zone becomes the intertropical convergence zone. (Casey-Arizona)
W71-04227

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
Middlebury Coll., Vt. Dept. of Geography.
Vincent H. Malmstrom.
Journal of Geography, Vol 68, No 6, p 351-357, September 1969. 5 fig.

Descriptors: *Climatic zones, *Classification, *Climatic data, *Water balance, *Temperature, Precipitation (Atmospheric), Evapotranspiration, Mosture deficit, Geographic regions, Mapping, Crops, Vegetation, Soil, Estimating equations, Vapor pressure, Monthly, Data collections.
Identifiers: *Potential evapotranspiration, *Climatic types, *Mosture index, *Warmth index, *Thornthwaite climatic classification.

While it represents a conceptual advance over the Koppen system, the Thornthwaite climatic classification is difficult in practice because parameter computations are tedious and their significance is obscure. Proceeding from the fact that saturation vapor pressure, a relative expression, is primarily a function of temperature, a method was devised for determining the 'water need' (N) of any given station by using only the average monthly temperature of that station. This was achieved by finding a threshold value giving a close approximation to the appropriate Thornthwaite potential evapotranspiration value and incorporation of a correction factor. The threshold value empirically decided upon was 25 mm at O deg. C. The water need for a given month may be obtained by dividing the saturation vapor pressure at the monthly temperature by the saturation vapor pressure at O deg. C., and multiplying by 25 mm. Annual water need is the sum of the monthly water needs. Annual precipitation may then be divided by annual water need to obtain a 'moisture index'. The average annual water budget of an area may by assessed by plotting both N and precipitation against time. A 'warmth index' (WI) was developed using a 6 deg. C. threshold value from growing-degree studies, discarding all months where N was less than 38 mm and subtracting 38 mm from all other months. Therefore WI—N-38 mm/100. Thus, for every station 4 parameters are obtained and it is the moisture index and WI that are employed in describing climatic differentiation. Resulting climatic maps using these indices are given and a number of valuable results are obtained and discussed. (Casey-Arizona)
W71-04235

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
V. P. Subrahmanyam, and C. V. S. Sastri.
Journal of the Meteorological Society of Japan, Vol 47, No 4, p 239-244, August 1969. 6 fig, 1 tab, 5 ref.

Descriptors: *Subhumid climates, *Droughts, *Water balance, *Climatic data, Precipitation (Atmospheric), Evapotranspiration, Statistical methods, Data collections, Climatology, Arid climates, Humid climates, Variability, Hydrologic cycle, Climatic zones, Fluctuation, Moisture deficit, Semiarid climates.
Identifiers: *Aridity index, *Potential evapotranspiration, *Agroclimatology, *India, *Thornthwaite's equation.

ttempting to evaluate drought, rainfall analysis nsufficient, water budgets alone are capable of ding objective data. Using Thornthwaite's hods, the dry regions of South India were de- cated into 3 climatic types-dry subhumid, iarid and arid. Deficiencies of 50% in rainfall in nid or arid climates do not greatly affect water nce. By contrast, drought study in dry subhu- zones is especially interesting because water nces fluctuate so frequently and violently. The ity index is the ratio of annual water deficiency otal annual water need. Drought intensity is uated by the departure of aridity indices from r median. Drought indices were plotted from 4 resentative weather stations for the period 1-1965. Plots of aridity index vs. time showed g-term trends in climatic shifts toward arid or nid. Plots of actual evapotranspiration, potential poration and rainfall vs. month give accurate ure of water balance fluctuations over a given r. This data is particularly crucial for agriculture ubhumid zones. (Casey-Arizona)
1-04298

. Snow, Ice, and Frost

ESTIGATION OF THE WATER REGIME SOILS IN THE AERATION ZONE, THEIR EEZING, WATER-PHYSICAL AND FILTRA- N PROPERTIES,
primary bibliographic entry see Field 02G.
1-03964

OBLEM OF THE CLASSIFICATION AND ATIAL VARIABILITY OF THE ALBEDO OF IOMOGENEOUS GLACIER SURFACE DUR- THE ABLATION PERIOD,
G. Konovalov.
nslated from Trudy TSANIGMI, No 44 (59), 9, p 102-107. Soviet Hydrology: Selected ers, No 4, p 406-409, 1969. 4 p, 4 tab, 5 ref.

criptors: *Estimating, *Glaciers, *Ablation, egimen, *Albedo, Statistical methods, Instru- ntation, Surveys, Melting, Measurement, mpling.
ntifiers: *Glacier albedo, USSR.

e results of albedo measurements on different ciers of the USSR show that despite the natural iability of the average albedo within the same e, the reflectivity of a melting glacier surface be reasonably well differentiated according to eral gradations resulting from a visual estimate the state of the active surface. The measure- nts were made mainly in clear and slightly clou- weather over an area of 1.2 sq km at elevations ween 2800 and 3000 m around noon. The nts where the albedo was measured were 30-50 part and distributed as evenly as possible in the ation area. The experimental data obtained re used to compute several statistical charac- stics. (Knapp-USGS)
1-03971

ME FEATURES OF THE MECHANICS OF ACIER MOVEMENT,
A. Litosh.
nslated from Trudy TSANIGMI, No 44 (59), 9, p 89-98. Soviet Hydrology: Selected Papers, 4, p 399-405, 1969. 7 p, 1 fig, 18 ref.

scriptors: *Glaciers, *Rheology, *Movement, n-Newtonian flow, Viscosity, Plasticity, Mathe- tical studies, Data collections, Regimen, Physi- properties.
ntifiers: *Glacier movement, *USSR.

solve the plane problem of the movement of an thermal mountain glacier for a cross section med by the vertical plane crossing the line of vement near the axis of the glacier, the dchenko Glacier, USSR, was selected for study. e lines of the longitudinal profile of the glacier face are properly approximated by a straight e. An approximation by second-degree polynomials is quite acceptable for the functions of the surface ice velocity, the difference in the mass balance at the surface, and the changes in the level of the glacier surface. The problem was solved by analyzing the process of steady-state creep or non-linear viscous flow. The initial system of equations was formulated in terms of the stress components. For steady-state creep, the general differential equations in terms of stress include balance equations and continuity equations analogous to the Beltrami-Mitchell equations in elasticity theory. The continuity equations are formed by excluding the rates of deformation by means of rheological equations from the St. Venant compatibility conditions. (Knapp-USGS)
W71-03972

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
For primary bibliographic entry see Field 02E.
W71-03975

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
J. O. Osterberg, and W. N. Fead.
Available from NTIS as AD-711 899, $3.00 in paper copy, $0.95 in microfiche. Special Report 32, Feb 1959. 9 p, 11 ref. Army Contract DA-11-190-ENG-6.
Identifiers: *Soils, Reviews, *Moisture, Soils, Thermal properties, Ice, Permafrost, Surface tension, Vapors, Pressure, Frost heave, Diffusion, Condensation.

The purpose of this study was to discover what work had been done on vapor diffusion in soils, in order to uncover any theory which might explain the occurrence of ice lenses in permafrost.
W71-04000

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
Scott Polar Research Inst., Cambridge (England).
C. H. Harrison.
Geophysics, Vol 35, No 6, p 1099-1115, December 1970. 7 p, 14 fig, 7 ref.

Descriptors: *Remote sensing, *Radar, *Glaciers, *Channel morphology, *Topography, Antarctic, Geomorphology, Movement, Instrumentation, Calibrations, Data collections.
Identifiers: *Subglacial relief, *Radio echo sounding.

In 1967 a party from the Scott Polar Research Institute, Cambridge, England, carried out a radio echo sounding survey of the Antarctic ice sheet. The radio echo sounding apparatus basically a pulse-modulated radar operating at 35 Mhz, was installed in a U. S. Navy Constellation aircraft. The fan-shaped beam is broadest along the line of flight, causing problems of interpretation analogous with those encountered in marine echo sounding and seismic surveying. Also, bottom echoes are affected by refraction at the ice surface. Examples of hyperbolic variations of echo delay with horizontal movement may be seen at the edges of ice shelves, crevasses, or cracks at the bottom of the ice. It is possible to distinguish specular from nonspecular reflections; the shape of the reflecting surface may be calculated. A computer program transforms the digitized film record into a real space profile. A cross-section of Nimrod Glacier and the bottom of the ice sheet near Vostok were plotted; in both cases there is a striking difference between the computed space profile and the echo profile. (Knapp-USGS)
W71-04112

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
For primary bibliographic entry see Field 02A.
W71-04136

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik. Science Inst.
For primary bibliographic entry see Field 02A.
W71-04137

SNOWMELT AND WATER YIELD FROM SNOW COVER,
State Hydrological Inst., Leningrad (USSR).
P. P. Kuzmin.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 591-598, 1969. 8 p, 1 fig, 1 tab, 2 ref.

Descriptors: *Snowmelt, *Flood forecasting, *Streamflow forecasting, Water balance, Heat budget, Water yield, Snowpacks, Snow surveys, Meteorology, Statistical methods, Frequency analysis.
Identifiers: Snowmelt forecasting.

Research methods of assessing snowmelt and water yield from snow cover to provide data for analysis of spring flood formation and runoff calculation are discussed. The main parameters of snowmelt and water yield are mean water equivalent of snow cover and its areal distribution up to the beginning of the snowmelt period, hourly and daily variations of snowmelt intensity, characteristic snowmelt dates and stages, and rate of water yield from snow cover. To determine mean water equivalent of snow cover, snow surveys based on periodical statistical sampling are performed; distribution (frequency) curves of water equivalent of snow cover are plotted. To determine snowmelt and rate of water yield, methods are based on consideration of components of the heat and water balance of the snow cover, as well as an empirical formula using standard meteorological observations from the hydrometeorological network. Water yield from snow cover is derived from the water balance equation. (Knapp-USGS)
W71-04171

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOW-MELT PERIOD,
State Hydrological Inst., Leningrad (USSR).
A. G. Kovzel.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 598-607, 1969. 10 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Water yield, *Snowmelt, *Streamflow forecasting, Water balance, Heat budget, Snowpacks, Snow surveys, Meteorology, Statistical methods.
Identifiers: Snowmelt forecasting.

Computation of water yield from snow involves the transformation of snowmelt water and rainfall by the snow pack on the surface of the watershed for any time interval of the whole snowmelt period. The scheme is applied to detailed investigation of runoff formation by snowmelt on watersheds as modified by the influences of physiography and man's activity. Snowmelt intensity is computed by the method of heat budget of the snow pack, or by means of simpler computation schemes based on the application of standard meteorological observation data. To characterize the snow cover distribution over a watershed, the mass curve of water equivalent distribution should be used. Tables permit computation of the outflow of snowmelt water from the snow pack on the surface of the basin at

two of the most common indices of the water-holding capacity of snow. The method also provides a means of estimation of the total area of the basin free from snow for any moment during the snowmelt period without using direct measurements. (Knapp-USGS)
W71-04172

SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
Research Inst. for Water Resources Development, Budapest (Hungary).
M. Hegedus, and K. Szesztay.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 616-628, 1969. 13 p, 8 fig, 3 ref.

Descriptors: *Snow surveys, *Runoff forecasting, *Water equivalent, Snowpacks, Snowmelt, Streamflow forecasting, Flood forecasting, Sampling, Monitoring, Gaging stations, Water yield.
Identifiers: *Hungary.

During recent years 52 stations and 2 experimental areas have been installed in the framework of preliminary investigations for elaborating a Hungarian national program for snow measurement. The first results of these measurements are evaluated. The following problems are discussed: the conditions of equal accuracy in snow depth and water equivalent measurements; the real accuracy in determining snow density from depth and water equivalent data; factors affecting variability of simultaneous snow depth and density values along snow courses and within small areas; and theoretical bases of planning a combined application of snow depth and snow density measurements. (Knapp-USGS)
W71-04173

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
Meteorologischer Dienst der Deutschen Demokratisches Republik, Halle. Amt fuer Meteorologie.
M. Rachner.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 628-637, 1969. 10 p, 7 fig, 11 ref.

Descriptors: *Snowmelt, *Water yield, *Snowpacks, *Meteorology, *Energy budget, Streamflow forecasting, Water supply, Ablation, Snow surveys, Water equivalent.
Identifiers: Snowmelt forecasting.

Results of experiments to investigate and represent the snow-supply and the ablation of snow cover for the Selke catchment area, German Democratic Republic are presented. Methods of surveying snow cover are outlined. The ablation of snow cover is calculated by the aid of radiation measurements and the energy budget. Special measurements (gradients of climatic elements) showed significant local differences of snow-cover ablation. The importance of the experiments with regard to water management and hydrology is discussed. (Knapp-USGS)
W71-04174

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
Research Inst. of Amelioration, Prague (Czechoslovakia).
V. Zeleny.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 637-644, 1969. 8 p, 8 tab, 5 ref.

Descriptors: *Snowmelt, *Floods, *Water yield, Snowpacks, Flood forecasting, Streamflow forecasting, Data collections, Hydrologic data, Runoff, Runoff forecasting.
Identifiers: Czechoslovakia.

Among the causes of floods is snowmelt. Using the examples of runoff during the thawing in the experimental watersheds Mala Raztoka and Cervik in the Moravian-Silesian Beskids it is shown that in these mountain forested regions the thawing of snow is usually quite harmless because of the configuration of the landscape and of the presence of forests. In the course of 13 years there has not been a single case recorded of any flood wave with a maximum runoff above 367 liters/sec/sq km. (Knapp-USGS)
W71-04175

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
State Hydrological Inst., Leningrad (USSR).
A. A. Sokolov.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 671-680, 1969. 10 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Runoff forecasting, *Streamflow forecasting, *Snowmelt, *Flood forecasting, *Gaging stations, Statistical methods, Peak discharge, Topography, Climatology, Meteorology, Vegetation effects, Frequency analysis, Synoptic analysis.
Identifiers: USSR.

Investigations were performed to verify existing computation formulas on the basis of long period observations of 2300 stations in the USSR and to establish the most reasonable estimation scheme of snow melt maximum discharges in cases of absence or insufficiency of hydrometric data. The proposed estimation scheme is based on the depth of spring flood runoff and the reduction of the coefficient of runoff intensity (ratio of maximum specific discharge to the total depth of spring flood runoff) depending on catchment area. The principal parameters of the scheme are the coefficient of runoff intensity and the reduction parameter; they are assumed to be variables and are determined on empirical data for each natural zone. Rivers of mountain regions are considered separately. The estimation scheme takes into account individual basin features affecting snowmelt maximum runoff such as: lake percentage and distribution over the basin; swamp percentage and swamp characteristics; forest percentage and relief and soil characteristics of the basin. (Knapp-USGS)
W71-04177

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W71-04178

ANALYSIS OF SNOW MELT FLOODS,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 02E.
W71-04179

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
H. Grasnick.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 607-615, 1969. 9 p, 4 fig, 3 tab, 6 ref.

Descriptors: *Snowmelt, *Water yield, *Streamflow forecasting, *Snow surveys, Snowpack, Water supply, Flood forecasting, Statistical methods, Meteorology.
Identifiers: Snowmelt forecasting.

The extreme snow conditions in the German Democratic Republic in the beginning of March 1965 caused a problem of evaluation of the water supply to be expected from a large snow-covered area. By means of an ad hoc snow survey it was possible to appraise the situation in flood-developing territories and to plot maps (scale 1:500,000). By evaluating these maps in terms of snow depth and density, the mean areal value of water supply for several river basins was calculated. The values obtained by various methods gave good agreement. Correlations were found concerning dependence of the water supply on the altitude, but no relation between snow density and altitude. (Knapp-USGS)
W71-04180

THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W71-04248

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
Ronald D. Tabler.
Proceedings of the Workshop on Snow and Ice Hydrology, Colorado State University, p 134-135, August 18-22, 1969.

Descriptors: *Research facilities, *Snow management, Sagebrush, Snowpacks, Water yield improvement, Soil-water-plant relationships, Wyoming.
Identifiers: *Snow fences, Blowing snow.

This paper summarizes research conducted by the Rocky Mountain Forest and Range Experiment Station on snow movement and the management of snow on Wyoming's windswept plains. One area of research centers on the use of snow fences to increase usable water yield or to augment moisture available for on-site use. Snow accumulation and melt are also being studied as part of a program to determine the hydrologic characteristics of sagebrush (Artemisia L.) lands and to evaluate the effects of current sagebrush control programs to improve forage values on western rangelands. (Tabler-Forest Service)
W71-04249

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W71-04251

ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Noel C. Gardner, and Arthur Judson.
USDA Forest Service Research Paper RM-61, 1970. 26 p, 1 tab.

Descriptors: *Snow, *Avalanches, Explosives, Highways, Snow management, Snow pack.
Identifiers: *Avalanche control, Avalanche forecasting, Artillery.

Presents planning and operational procedures, and discusses criteria for avalanche control and the evaluation of avalanche hazard based on field data.

lines a method for determining when gunfire uld commence. Gives basic information neces- for formulating operational forecasts for nway maintenance and avalanche control per- nel based on: mountain weather forecasts, traf- density, and current snow conditions. Explains rument needs in detail. (Judson-Forest Service)
1-04258

. Evaporation and Transpiration

LUENCE OF LOW RATES OF WATER AP- CATION BY SPRINKLERS ON THE CROCLIMATE,
th Dakota State Univ., Brookings. Dept. of icultural Engineering.
n L. Wiersma.
ilable from NTIS as PB-197 112, $3.00 in er copy, $0.95 in microfiche. South Dakota e University Water Resources Center Project npletion Report for July 1965-June 1968. ember 1970. 84 p, 12 fig, 27 ref. OWRR Pro- No. A-006-S Dak (1).

criptors: *Sprinkler irrigation, *Irrigation effi- cy, *Evapotranspiration, *Water loss, *Crop onse, Irrigation design, Irrigation operation maintenance, Irrigation practices, Soil-water- t relationships, Microclimatology.
ntifiers: *Low-rate sprinkler irrigation.

analysis was made of water losses due to poration within the wetted area of a low appli- on rate sprinkler system operating during light hours under conditions of slight to derate breezes. The magnitude of evaporation from the sprinkled area was determined by asuring the absolute humidity, temperature, and d speed profiles immediately upwind and nwind from a large bromus grass field where r-horizontal homogeneity existed prior to ration of the sprinkler. Sprinkler discharge rate operating pressure had minimal effect on water . The losses were mainly evaporation from plant faces, and were as high as one-half of the sprin- water discharge. The greatest decrease in potranspiration was adjacent to the wetted area. eld 70 meters downwind from the sprinkler line unaffected. Approximately one-eighth of the er that evaporated within the sprinkled area was et by a decrease in evapotranspiration in the 70 meters downwind. The rate of water appli- on had minor effects on the water application ciency. Irrigation design efficiency should not substantially affected if application rates are uced for cost efficiency. (Knapp-USGS)
1-03925

PROVING EFFICIENCY IN AGRICUL- RAL WATER USE,
orado State Univ., Fort Collins. Natural ources Center.
primary bibliographic entry see Field 03C.
1-04049

ROMETEOROLOGY SURVEY OF THE GHLANDS OF EASTERN AFRICA,
H. Brown, and J. Cocheme.
ture and Resources, Vol 6, No 3, p 2-10, Sep- ber 1970. 5 fig, 2 tab.

scriptors: *Evapotranspiration, *Crops, *Cli- tic data, *Rainfall, *Regional analysis, Grasses, mperature, Ecosystems, Fungi, On-site in- tigations, Crop response, Water balance, En- onmental effects, Semiarid climates, Tropical re- ns, Data collections, Soil properties, Agricul- e, Seasonal, Plant growth, Monthly, Water uirements.
ntifiers: *East Africa, *Agroclimatology, otential evapotranspiration, *Penman's formula, ffee, Tef, Pyrethrum, Tea.

eastern Africa highland region including parts Kenya, Uganda, Tanzania, and Ethiopia was sur- veyed for climatic factors influencing crop production. The climatic needs and tolerances of various regional crops were also determined and the 2 sets of data were compared so that agriculture in the area would achieve maximum crop production efficiency. Meteorological data from 35 stations were used for calculation of potential evapotranspiration according to Penman's formula. Circular monthly maps of rainfall and potential evapotranspiration were constructed for various areas and the water requirements of given crops could be superimposed upon the maps to determine how closely they matched the water balance of the area. Four crops- -Coffee (ccoffea arabica), tef (Eragrostis tef), pyrethrum (Chrysanthemum cinerareifolium) and tea (Camellia sinensis) -- are reviewed with respect to growth requirements, tolerances and optimal cultivation conditions. (Casey-Arizona)
W71-04062

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA; AN ALTERNATIVE METHOD OF PENMAN,
California Univ., Los Angeles. Dept. of Geography.
Oyediran Ojo.
Archiv fur Meteorologie, Geophysik und Bioklimatologie, Series B, Vol 17, No 2-3, p 239-260, 1969. 10 fig, 28 ref.

Descriptors: *Evapotranspiration, *Water balance, *Vegetation, *Regional analysis, *Climatic data, Precipitation (Atmospheric), Deserts, Arid lands, Temperature, Humidity, Seasonal, Turbulence, Advection, Convection, Grasslands, Evaporation pans, Energy budget, Heat balance, Biogeography, Winds, Solar radiation, Weather patterns, Theoretical analysis, Estimating equations, Statistical methods, Gradation, Climatic zones, Rainfall, Air masses, Field capacity, Soil moisture, Soil types, Plant groupings, Forests, Stations, Maps, Measurement, Data collections.
Identifiers: *Potential evapotranspiration, *West Africa, *Psychrometers, *Bowen ratio, *Aerodynamic components, Inter-tropical convergence zone, Net radiation, Formulae.

A number of methods of calculating potential evapotranspiration (PE) are reviewed with respect to their applicability to West African climates. Since gradient measurements are difficult and complicated by advection in arid areas, Penman's formula, utilizing an aerodynamic component and an energy component, is preferable. The net radiation term is more important than the aerodynamic term and will therefore be the major source of error in calculated evaporation values. This term was modified using ordinary meteorological parameters. Linear relationships were found between measured values of evaporation using a Piche evaporimeter and calculated values from the original and modified formulae and the aerodynamic term. PE isolines were mapped for West Africa in different seasons. Water balance is the difference between precipitation (P) and PE and P-PE isolines were plotted for different months. Annual water balances were then compared with 10 vegetation zones. The forest-samanna boundary is delimited by P-PE-O and the savanna-desert boundary by P-PE- -3000 mm. Interpretations are sometimes difficult because of modification or degradation of vegetation zones. The data seem to justify use of this empirical formula for agricultural planning, but justification for many of the assumptions awaits the introduction of more sophisticated measuring devices. (Casey-Arizona)
W71-04063

PERCH LAKE EVAPORATION STUDY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 02A.
W71-04142

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
J. Oliver.
Journal of Tropical Geography, Vol 20, No 1, p 64-74, June 1969. 4 fig, 3 tab, 31 ref.

Descriptors: *Evapotranspiration, *Rainfall, *Vegetation, *Semiarid climates, *Water balance, Climatic data, Climatic zones, Vegetation effects, Soil texture, Soil structure, Runoff, Infiltration, Distribution patterns, Diurnal, Ecosystems, Slopes, Arid lands, Tripical regions, Advection, Irrigation effects, Xerophytes, Water vapor, Maps, Sands, Clays, Temperature, Soil temperature, Solar radiation, Energy budget, Topography, Permeability, Rainfall disposition, Evaporation, Winds, Environmental effects, Mode of action, Data analysis, Frequency, Variability.
Identifiers: *Potential evapotranspiration, *Sudan, *Thornthwaite method, *Penman method, *Oasis effect, Plant cover.

In low latitude semiarid areas there is a high level of energy supply so that potential water losses by evaporation and transpiration are large. The 2 main moisture regions of the Sudan are arid and semiarid and a potential evapotranspiration map, a rainfall map and a water deficit map of the country are included. However, in an area with such climatic characteristics, actual evapotranspiration may be considerably different from potential evapotranspiration. Factors responsible for this involve sparse or patchy plant cover resulting in accentuation of the advective 'oasis effect', macro- and microreflief which affect runoff/infiltration ratios, and soil structure and texture which determine infiltration, which in turn affects both runoff and water volume in soil surface layers available for evaporation. Data are given on solar radiation which is a guide to the maximum rate at which rainfall should be lost at the surface. The temporal pattern and extent of rainfall is discussed relative to infiltration and evaporative parameters. In the Sudan there are 2 situations in which actual evapotranspiration will depart from potential evapotranspiration. In unirrigated sparsely vegetated areas, actual losses will be higher than estimates, and in irrigated areas they will be lower than estimates. (Casey-Arizona)
W71-04236

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Robert S. Johnston, Ronald K. Tew, and Robert D. Doty.
USDA, Forest Serv Res Paper INT-67, 1969. 13 p, 2 fig, 2 tab.

Descriptors: *Water yield improvement, *Evapotranspiration, *Water loss, *Evapotranspiration control, *Soil water, Soil moisture, Nuclear moisture meters, Soil moisture meters, Oak trees, Forest management, Watershed management, Land management, Water conservation, Vegetation effects, Utah, Mountain forests.
Identifiers: Experimental watersheds, Aspen trees.

Soil moisture depletion was measured with a neutron moisture probe on 14 sites representing 10 vegetation types on mountain watersheds in Utah. A water balance equation was used to estimate evapotranspiration (ET). Both soil moisture depletion and ET varied considerably between sites and from year to year. Aspen (Populus tremuloides) sprouts utilized from 0.48 to 4.50 in. less water from 6 ft. of soil than mature aspen; Gambel oak (Quercus gambelii) sprouts utilized from 0.25 to 1.15 in. less water than mature oak. By converting aspen to grass, ET losses were reduced from 1.08 to 5.18 in. from the surface 6 ft. of soil and up to 7.59 in. from a 9-ft. soil depth. (Knapp-USGS)
W71-04242

2E. Streamflow and Runoff

THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
Indiana Univ., Bloomington. Dept. of Geography; and Oregon State Univ., Cornwallis. Dept. of Civil Engineering.
Michael C. Roberts, and Peter C. Klingeman.
Journal of Hydrology, Vol 11, No 4, p 393-411, November 1970. 19 p, 11 fig, 2 tab, 15 ref. OWRR Project A-001-ORE (7).

Descriptors: *Hydrograph analysis, *Hydraulic models, *Rainfall-runoff relationships, Antecedent precipitation, Depth-area-duration analysis, Duration curves, Permeability, Overland flow, Hydraulic similitude, Rainfall intensity, Hydrographs.
Identifiers: *Watershed models.

A laboratory model watershed was used to determine important factors that affect stream hydrographs. The factors selected for experimental variation are rainfall intensity, rainfall duration, storm movement, permeability, and antecedent moisture conditions. Systematic changes in the flood hydrographs, caused by controlled variation of these factors, are described. Given 100% basin cover and wet antecedent conditions, the intensity of rainfall causes a marked difference in the magnitude of the discharge hydrograph. The direction of storm travel over a drainage basin may aggravate or reduce flood peaks. In regions subject to recurrent directions of major storms, the predominant direction of storm movement can give definition to a 'characteristic' hydrograph shape. Variations in this shape may result from differences in the rate of storm movement. With increasing permeability, time to equilibrium also increases. Antecedent moisture conditions are very important in determining flood magnitude. The pre-storm moisture level is responsible for wide variations in peak discharge values resulting from similar storm events. (Knapp-USGS)
W71-03871

MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
New Zealand Forest Service, Wellington. Protection Forestry Branch.
For primary bibliographic entry see Field 07B.
W71-03930

FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
Harlan H. Schwob.
Geological Survey Open-file report, October 1970. 18 p, 8 plate, 2 ref.

Descriptors: *Floods, *Profiles, *Iowa, Urbanization, Water levels, Data collections, Mapping, Maps, Surveys, Flood damage, Flood plains, Planning, Water management (Applied).
Identifiers: *Hoosier Creek (Iowa), *Linn County (Iowa), *Cedar Rapids (Iowa).

A flood-profile study was made for Hoosier Creek and its tributary South Hoosier Creek, Linn County, Iowa. The reaches studied extend from near the south Linn County line upstream to U.S. Highway 218 on Hoosier Creek, and from the mouth to U.S. Highway 218 on South Hoosier Creek. A total of about 11 miles of stream is included in the two reaches. The profiles shown in the report are computed for a very large flood under existing valley conditions and for a smaller flood under two assumed conditions of encroachment. This information can be used to supplement the existing county zoning ordinances for flood plains and to aid in future flood-plain management when part or all of the area, adjacent to the south limit of the city of Cedar Rapids, is urbanized. (Knapp-USGS)
W71-03932

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 07A.
W71-03933

MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
I. N. Dreyer.
Translated from Izvestiya Akad nauk SSSR, ser geogr No 6, p 69-73, 1969. Soviet Hydrology: Selected Papers, No 5, p 519-524, 1969. 6 p, 1 map, 1 tab, 17 ref.

Descriptors: *Maps, *Runoff, *Streamflow, River flow, Mapping, Discharge (Water), River forecasting, Water management (Applied), Hydrologic data, Data collections.
Identifiers: *USSR, *Streamflow maps.

A map of the streamflow of the USSR is presented and former streamflow compilations are reviewed. The annual streamflow of the USSR is about 4350 cu km. The data were compiled on working maps scaled 1:10 million. (Knapp-USGS)
W71-03960

HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
V. V. Golubtsov.
Translated from Trudy KazNIGMI, No 33, p 30-41, 1969. Soviet Hydrology: Selected Papers, No 5, p 500-511, 1969. 12 p, 3 fig, 1 tab, 26 ref, append.

Descriptors: *Open channel flow, *Hydraulics, *Stage-discharge relations, Chezy equation, Mannings equation, Roughness (Hydraulic), Depth, Slopes, Equations, Turbulent flow, Turbulence, Hydraulic gradient.
Identifiers: *USSR, *Mountain stream hydraulics.

The resistance to flow in mountain rivers generally increases as a result of the effect of hydrodynamic parameters (slope, in particular) on the conditions of flow, rather than as a result of increasing channel roughness. Only the physical conditions of flow in rivers with slopes less than 0.001 correspond to the square law of resistance. Pressure losses through resistance to flow in rivers with slopes less than 0.004 are proportional to average velocity in the sixth power. A gradual transition from the square law of resistance to resistances proportional to the average flow velocity in the sixth power is observed in the range of slopes 0.001 to 0.004. These results substantiate the conclusion derived from laboratory experiments that there is a resistance zone where velocity continues to affect resistance through the Froude number for increasing values of the Reynolds number. To compute the average velocity of mountain rivers of slope greater than 0.001 an empirically derived exponential equation relates velocity to slope, flow depth, and hydraulic roughness. (Knapp-USGS)
W71-03961

HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
For primary bibliographic entry see Field 02J.
W71-03965

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
I. F. Karasev.
Translated from Trudy Gos Gidrol Inst-ta, No 172, p 3-21, 1969. Soviet Hydrology: Selected Papers, No 5, p 429-442, 1969. 14 p, 6 fig, 2 tab, 15 ref.

Descriptors: *Floods, *Flood plains, *Channel morphology, *Chezy equation, *Open channel flow, Hydraulics, Discharge (Water), Mannings equation, Roughness (Hydraulic), Hydraulic radius.
Identifiers: *USSR.

The momentum equation, which allows for mass exchange at the lateral boundaries, permits an overall estimate of the influence of the banks and flood plain on flood conveyance. The working relationships include a limited number of empirical parameters: one for a channel without a flood plain and two for the flood-plain channel. The dynamic scheme, which allows for the mechanism of lateral mass exchange, has significant advantages over the correlative-statistical relationships, which give less accurate results. (Knapp-USGS)
W71-03968

PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
For primary bibliographic entry see Field 02J.
W71-03969

MUD FLOWS AND FLOODS AND THEIR CONTROL,
For primary bibliographic entry see Field 02J.
W71-03970

WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
V. I. Moklyak, and L. V. Shcherbak.
Translated from Trudy UkrNIGMI, No 85, 1969, p 11-15. Soviet Hydrology: Selected Papers, No 4, p 370-375, 1969. 6 p, 1 fig, 12 ref.

Descriptors: *Stage-discharge relations, *Flood forecasting, *Velocity, Discharge (Water), Discharge coefficients, River forecasting, Streamflow forecasting.
Identifiers: USSR, *Travel time (Streamflow).

Methods of computing unsteady flow of streams during floods are briefly reviewed. New methods proposed in the USSR use travel time as the main parameter, but in real streams with variable cross-sectional areas, this is too difficult to compute. Formulas are given for use in estimating travel time coefficients using discharge, stage, and the average dimensions of the stream channel in question. (Knapp-USGS)
W71-03973

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
B. A. Kamalov.
Translated from Trudy TSANIGMI, No 44 (59), 1969, p 66-80. Soviet Hydrology: Selected Papers, No 4, p 388-398, 1969. 11 p, 3 fig, 2 tab, 15 ref.

Descriptors: *Streamflow forecasting, *Glaciers, *Regimen, *Melt water, *Melting, Climates, Altitude, Heat budget, Rainfall-runoff relationships, Runoff, Snowmelt, Water sources.
Identifiers: *USSR, *Glacial runoff.

Methods of analysis of flow in the mountains involve difficulties because of the few meteorological stations, especially in the high mountains, and meteorological factors vary greatly over the territory. For this reason, a system of methods of hydrologic computations for mountain areas was developed in the USSR from long-period investigations. These methods are based on the vertical zonality of natural processes in general and hydrometeorological processes in particular. In some rivers glaciers contribute a large portion of the annual flow. For example, the melting of glaciers accounts for 32% of the annual flow of the Sokh River, 35% of the Zarafshan River, 25% of the Aksu River, and 20% of the Isfayram River. There is a close local ralationship between the runoff rate of glacier-fed rivers and the ratio of average catchment elevation to the average height of the firn line. This relationship is described statistically. There is no common relationship between the runoff rate and the ratio of catchment elevation to the average height of the firn line for large regions. The reason for this is that glaciers of widely separate regions have different thermal and mass balances. (Knapp-USGS)
W71-03975

HARACTERISTICS OF THE CONSTRUCTION F EQUALLY PROBABLE FLASH FLOOD YDROGRAPHS,
F. Vishnevskiy, and G. M. Shcherbak.
anslated from Trudy UkrNIGMI, No 85, 1969, p -91. Soviet Hydrology: Selected Papers, No 4, p 5-381, 1969. 7 p, 3 fig, 3 tab, 5 ref.

escriptors: *Flash floods, *Hydrographs, *Flood recasting, *Probability, Hydrograph analysis, me series analysis, Statistical methods, River recasting, Runoff forecasting, Rainfall-runoff ationships.
entifiers: *Probability hydrographs.

oper and economical planning of spillway instal- ions and bridges requires hydrographs of flows of rying probability. These hydrographs also serve the basis of water management computations for h-water and flood flow regulation. To construct equally probable rain flood hydrograph, the ly rain water inflow depths of different proba- ity of excess are obtained after statistical analysis the series of computed inflow depths. The dif- ence between the maximum discharges of the sign hydrographs for the given probability of ex- s is about 24%, which is substantial. To estimate reliability of the computed equally probable sh flood hydrographs, these hydrographs were mpared with observed hydrographs. The com- rison was made between the computed equally obable hydrographs of a probability of excess p 2.0% and p — 3.0% and observed maximum sh flood hydrographs in 1897 and 1933, whose pirical probability approximately corresponds to computed probability. This comparison showed od agreement. (Knapp-USGS)
71-03976

TERMINATION OF THE DISTRIBUTION OF INFALL FLOODS IN LARGE CATCHMENTS ING HYDROMETEOROLOGICAL DATA,
eteorological Office, New Delhi (India).
Banerji, and D. C. Mantan.
Floods and Their Computation, Vol 1, Interna- nal Association of Scientific Hydrology Publica- n No 84 (Unesco-WMO), p 442-450, 1969. 9 p, g, 5 tab, 5 ref.

escriptors: *Rainfall-runoff relationships, *Flood recasting, *Peak discharge, *Low flow, Infiltra- n, Water storage, Hydrologic data, Routing, ater yield, Streamflow forecasting, Antecedent ecipitation, Depth-area-duration analysis, drograph analysis, Base flow.
entifiers: India, Streamflow estimating.

ck of hydrological data is an impediment for sign purposes of dams and reservoirs in most of catchments in the developing countries. Some ve fortunately a long period of hydrometeorolog- l data for these catchments. A method has been olved by which the daily flood formation at the int of discharge due to rain storms affecting dif- ent zones of the catchment is determined. An uation, in which the storage factor is directly re- ed to the antecedent precipitation and as such es account of infiltration and retention capacity the basin, is used for the determination of the od crest. Since the contribution from different nes of the larger catchment to the flood at the int of outflow is estimated on its antecedent and ncurrent rainfall reduced by the storage factor propriate to the wetness of the catchment, this thod does away with the laborious process of od estimation by stream routing methods. The thod is not only useful in the evaluation of day to y crest forecast for a large basin influenced by even rainfall distribution, but it may also be used estimation of low flow for countries subject to oughts. (Knapp-USGS)
71-03977

VALUATION OF MAXIMUM RAINFALL SCHARGE FROM A REGION OF DEFICIENT AINFALL DATA,
m Dum Airport, Calcutta (India); and eteorological Office, New Delhi (India).
K. Datta, and D. K. Gupta.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 432-442, 1969. 11 p, 3 fig, 4 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Estimating, *Flood forecasting, *Streamflow forecasting, *Statistical methods, Hydrograph analysis, Storm runoff, Duration curves, Depth-area-duration analysis.
Identifiers: India.

It is advantageous to use a river catchment or a part of one as a unit for quick evaluation of average basin rainfall and thus base the possible discharge on the highest rainfall recorded in the area. The Gompertz equation, which is flexible to represent various types of depth area relation, may be utilized to compute average rainfall in a river catchment based on a central value. The physical method of picking up central rainfall values in case of meager rainfall reports is suggested. (Knapp-USGS)
W71-03978

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
Electricite de France, Chatou. Centre de Recherches et d'Essais.
J. Jacquet, and J. Bernier.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 419-431, 1969. 13 p, 6 fig, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, *Frequency analysis, *Peak discharge, *Probability, Statistical methods, Data collections, Unit hydrographs, Hydrograph analysis, Streamflow forecasting.
Identifiers: France.

The classifical methods of frequency analysis of floods cannot be used in the case of incomplete information (small sample of flood data, large sample of rainfall data). If the rainfall and discharge data permit the definition of a function, such as the unit hydrograph, it is possible to calculate the probabilities of a flood based upon the stochastic process of rainfall and runoff coefficients. This method is explained and its application and comparisons with classical methods are given. (Knapp-USGS)
W71-03979

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
Transdanubian Water Authority, Szekesehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02A.
W71-03980

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
Research Inst. for Water Resources Development, Budapest (Hungary); and Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
P. Wirth, and I. Zsuffa.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 404-408, 1969. 5 p, 3 fig, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Unit hydrographs, *Hydrograph analysis, *Synthetic hydrology, Statistical methods, Flood forecasting, Estimating, Discharge (Water), Peak discharge.
Identifiers: Synthetic hydrographs, Hungary.

The analysis of hydrographs observed on experimental basins in Hungary is outlined. The relations between the parameters of the unit hydrographs and the physical and geographical characteristics of the basin are analyzed. The methods of estimation of the principal elements of the unit hydrograph, when there are no discharge records, are given. (Knapp-USGS)
W71-03981

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
Akademiya Nauk Armyanskoi SSR, Erevan; and Ministry of Reclamation and Water Economy, Erevan (USSR). Water Problems and Hydrotechnics Research Inst.
For primary bibliographic entry see Field 02A.
W71-03982

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
Grenoble Univ. (France).
For primary bibliographic entry see Field 02A.
W71-03983

ANALYSIS OF FLOOD DURATION (FRENCH),
Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
I. Zsuffa.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 362-368, 1969. 7 p, 5 fig, 2 ref.

Descriptors: *Flood forecasting, *Frequency analysis, *Duration curves, Depth-area-duration analysis, Probability, Statistical methods, Flood protection.
Identifiers: Hungary, Danube River.

Knowledge of the height of a floodwave is essential from the point of view of the size of the protection dikes. The duration of the flood must be taken into consideration when considering the resistance of dikes to absorption, erosion and breaking. Each of these factors can be considered as a random variable. The methods used for estimating the probability of different heights of flood are well known. Methods are described for the determination of the function of floodwave duration distribution. (Knapp-USGS)
W71-03984

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
National Office of Irrigation, Rabat (Morocco).
R. Hazan, and D. Lazarevic.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 354-361, 1969. 8 p, 5 fig.

Descriptors: *Flood forecasting, *Peak discharge, Frequency analysis, Hydrograph analysis, Gaging stations, Networks, Statistical methods, Hydrology.
Identifiers: Morocco.

A synthetic study of the hydrology of Morocco has permitted the deduction of the laws of evolution in hydrology thus making possible the computation of peak discharges for different frequencies, the evaluation of the volume of flood flows and the determination of flood hydrographs in a characteristic zone. The method reported enables the rapid computation of these data for zones without a gaging network and it can be widely employed. (Knapp-USGS)
W71-03985

MAXIMUM DISCHARGE OF MAJOR RIVERS IN LARGE FLOOD PLAINS IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Faiz Ahmed.

In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 336-349, 1969. 14 p, 7 fig, 3 tab, 5 ref.

Descriptors: *Floods, *Peak discharge, Data collections, Hydrologic data, Water supply, Sediment load, Hydrology, Streamflow, Discharge (Water), Hydrographs, Frequency analysis.
Identifiers: East Pakistan, Brahmaputra River.

Measurement of maximum discharges of the major rivers in East Pakistan is a complex problem. Results of a study carried out in 1965 are outlined. About 70% of total flow entering East Pakistan was contributed by the Brahmaputra which has a maximum weekly discharge of 29.8 million acre feet; the Ganges contributed about 28% and the remaining 2% was contributed by small streams. The maximum storage was small at the peak flood in relation to the water passing through the system. The outflow lagged (on account of storage) only slightly behind the inflow. Rainfall was an important factor and kept pace with the increase in storage up to peak value. The maximum flood of 4.5 million cfs given by Mayer's rating or 4.0 million cfs subtracting 10% as escape flow, has a mean return period of 1500 years. (Knapp-USGS)
W71-03986

PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
Hydrographic Office of the Po River, Parma (Italy).
U. Raffa.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 330-336, 1969. 7 p, 3 fig, 2 tab.

Descriptors: *Flood forecasting, *Statistical methods, *Rainfall-runoff relationships, Discharge (Water), Stage-discharge relations, Frequency analysis.
Identifiers: Po River (Italy).

The procedure adopted for the elaboration of the probable statistical characteristics of the flooding of the Po River of Italy is described and the application of the Gherardelli-Marchetti formula is illustrated. The procedure yields unit flood discharge for a given probability. Tables and the graphs are designed for the rapid evaluation of the first approximation of flood discharges in a river cross-section, knowing the morphological characteristics of the drainage basin and its area. (Knapp-USGS)
W71-03987

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
Vsesoyuznyi Nauchno—Issledovatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR); and Khabarovsk Inst. of Railway Engineers (USSR).
For primary bibliographic entry see Field 02A.
W71-03988

DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
Guelph Univ. (Ontario). School of Agricultural Engineering; and Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.
H. D. Ayers, and J. Balek.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 505-510, 1969. 6 p, 6 fig, 5 ref.

Descriptors: *Water balance, *Runoff forecasting, *Mathematical models, Routing, Hydrograph analysis, Rainfall-runoff relationships, Discharge (Water), Water storage, Flood forecasting, Synthetic hydrology.
Identifiers: Flood hydrographs.

A mathematical model providing hourly water balance information for summer, winter and combined regimes was developed. The model yields hourly volumes of surface runoff in addition to much other supplementary output information. The routing section of the model produces the three components of the hydrograph. Constant and variable parameters characterizing a general watershed are discussed from the viewpoint of surface runoff development and time distribution. (Knapp-USGS)
W71-03989

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
Consejo Superior di Investigaciones Cientificas, Madrid (Spain). Instituto de Hidrologia.
R. Heras.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 492-504, 1969. 13 p, 10 fig, 7 tab, 5 ref.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, Statistical methods, Depth-area-duration analysis, Routing, Data collections, Streamflow forecasting, Estimating, Hydrograph analysis.
Identifiers: Spain.

Because of the great irregularity of river regimes in Spain and to the total or partial absence of hydrological data, the problem of maximum river flood computation is a very complex one. From the point of view of the economy, it is important to forecast flood levels and maximum discharges. This report contains a summary of different methods (direct, empirical, statistical and hydrometric), which in general are used simultaneously to compare different results and to try to estimate the highest flood values with the maximum possible accuracy. (Knapp-USGS)
W71-03990

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02A.
W71-03991

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
Zakavkazskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Tiflis (USSR).
C. D. Rostomov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 462-472, 1969. 11 p, 3 fig, 3 tab.

Descriptors: *Storm runoff, *Maximum probable flood, *Rainfall-runoff relationships, *Depth-area-duration analysis, Routing, Time of concentration, Duration curves, Mass curves, Hydrographs, Analytical Techniques.
Identifiers: USSR.

Maximum regional discharge is examined as a function of morphometric data, vegetal cover and climatic (storm) conditions. The solution is based on the principle of equality of the time of concentration and of the storm duration, which is composed of the time of travel along the slopes and along the river channel. The flow of water along the slopes is considered as steady flow; its analysis is based on the water balance equation of an elementary plot. For generalization and averaging of phenomena during runoff formation the concept of 'adjusted' length of the watercourse is used. This facilitates solution of the design storm duration, which is the principal element of storm runoff computation. For a more accurate account of runoff factors, some features of irregularity of storm intensity, storm areal distribution, and of the shape of the catchment area have been introduced in design formulas. (Knapp-USGS)
W71-03992

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Sam Shulits, and Ralph D. Hill, Jr.
Available from NTIS as PB-194 950, $3.00 in paper copy, $0.95 in microfiche. Hydraulics Laboratory Bulletin, ARS-SWC-1, Dec 1968. 218 p, 89 ref. Dept of Agriculture Contract 12-14-1000-8872 (41).
Identifiers: *Bed load, Mathematical models, *Channels, Waterways, Sediment transport, Channel flow, Erosion, FORTRAN, Computer programs.

Formulas for computing bedload are reviewed, and FORTRAN program listings are given for digital computer solution of 14 of them. The programs are for the formulas of Schoklitsch, Meyer-Peter, Casey, Haywood, Straub, Waterways Experiment Station, Shields, Kalinske, Meyer-Peter and Muller, Eizerman and Frijlink, Laursen, Rottner, and Einstein. Results of the formulas are compared by calculating and plotting sediment discharge against water discharge for all of them. Each formula is presented in its original form and units, and its use is explained as the originator intended. It is concluded that 3 of the formulas give the best results, with adequate agreement with data. The Schoklitsch (1934) formula is selected as the best relation of bedload to discharge. The Straub and they Meyer-Peter and Muller formulas are selected as the best relations of bedload to tractive force. The 3 formulas are valid for effective particle diameters from 0.3 to 7 mm. The Schoklitsch (1934) formula is proposed as the best of the 3 because of its simple form and because it produces directly a bedload-discharge rating curve.
W71-03999

INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 04A.
W71-04002

SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
North Carolina Univ., Chapel Hill.
David H. Moreau.
Presented at 17th ASCE Hydraulics Division Conference, Logan, Utah, Aug 20-22, 1969. 14 p, 2 fig, 2 tab, 7 ref, append. OWRR Project A-043-NC (1).

Descriptors: *Stochastic processes, *Hydrology, *Streamflow, *Monthly, Time, Monte Carlo method, North Carolina.
Identifiers: Maxima, Minima, Haw River.

The object of this paper was to report on progress of current research to divise a technique for superimposing variability of stream flows having a duration of less than a month onto monthly flow sequences, whenever the probability of an extreme event occurring within the month was sufficiently large. There were two analyses of interest; first, an examination of relationships between maxima and minima of stream flows averaged over some submonthly time period to flows averaged over a month; and second, a technique for superimposing sub-monthly flows on monthly flows. Reported were results of: (a) a Monte Carlo technique for finding distributions of peak-to-mean and minima-to-mean ratios of weekly flows on monthly values, and (b) a technique for generating sub-monthly flows such that the first three moments and correlations among deviations of sub-monthly flows from

nthly flows were preserved. Analyses were ed on 34 years of recorded observations on the v River at Pittsboro, North Carolina near the struction site for New Hope Dam. (Kriss-Cor-)
1-04040

AIN MODEL OF RIVER MEANDERS,
ois Univ., Urbana. Dept. of Metallurgy and ing Engineering.
. Thakur, and A. E. Scheidegger.
rnal of Hydrology, Vol 12, No 1, p 25-47, ember 1970. 23 p, 14 fig, 13 ref.

criptors: *Meanders, *Geomorphology, annel morphology, *Simulation analysis, istical methods, Stochastic processes, Monte lo method, Correlation analysis, Profiles, del studies, Probability.
ntifiers: Meander models.

an explanation of river meanders, a statistical roach is promising. In order to put such an ap-ach upon a sound theoretical basis it is necessa-o calculate expectation values of certain ob-ables (such as the meander spectrum) over a -defined ensemble. Because of the difficulty of dom-generating meander patterns for given ndary conditions, an empirical approach was l. A chain was used to generate simulated nders. Keeping both ends of the chain fixed, an mble of random curves of a given sinuosity can generated. Different ensembles can be erated by varying the end separation, keeping length of the chain constant. Values of statisti-relationships were found from the ensembles compared with data obtained from actual rs. (Knapp-USGS)
1-04124

E UNIVERSALISATION OF THE CO-OR-ATES OF LOGARITHMIC WEIR OFILES,
an Inst. of Science, Bangalore. Dept. of Civil Hydraulic Engineering.
primary bibliographic entry see Field 07B.
1-04127

E TRAPEZOIDAL FREE OVERFALL,
erta Univ., Edmonton. Dept. of Civil Engineer-

primary bibliographic entry see Field 08B.
1-04128

PERIMENTAL STUDIES ON LINEAR PRO-RTIONAL WEIRS WITH TRIANGULAR TTOMS,
an Inst. of Science, Bangalore. Dept. of Civil Hydraulic Engineering.
primary bibliographic entry see Field 08B.
1-04129

TALOG OF INFORMATION ON WATER TA, EDITION 1970-INDEX TO SURFACE TER SECTION.
logical Survey, Washington, D.C. Office of er Data Coordination.
primary bibliographic entry see Field 07C.
1-04151

EDICTION OF FLOODS FROM HEAVY NFALL,
an Meteorological Agency, Tokyo. Forecast ion.
ji Ishihara.
Forecasting of Heavy Rains and Floods, Proc t Seminar of Regional Associations 2 and 5 of rld Meteorological Organization, Nov 11-23, 8, Kuala Lumpur, Malaysia, published by rld Meteorological Organization, Geneva, p -172, 1970. 60 p, 28 fig, 7 tab, 10 ref.

Descriptors: *Flood forecasting, *Flood routing, *Rainfall-runoff relationships, Hydrograph analysis, Warning systems, Rational formula, Precipitation intensity, Antecedent precipitation.
Identifiers: *ECAFE, *Asia.

Methods of flood forecasting are reviewed and illustrated by worked examples. The methods discussed are the Thiessen polygon method, the isohyetal method, hydrograph analysis, antecedent moisture calculations, unit hydrographs, rational formula, the Muskingum method, and the Puls method. Proper organization and operation of flood forecasting services involves personnel selection, data collections, data collection network, and information distribution facilities. (Knapp-USGS)
W71-04159

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
Burma Meteorological Dept., Rangoon.
For primary bibliographic entry see Field 02B.
W71-04164

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
Burma Meteorological Dept., Rangoon.
Ba Kyi.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 221-242, 1970. 22 p, 16 fig, 1 tab, 4 ref.

Descriptors: *Floods, *Rainfall-runoff relationships, *Flood forecasting, *Monsoons, *Tropical cyclones, Synoptic analysis, Rainfall intensity, Storms, Weather forecasting, Climatology, Meteorology.
Identifiers: *ECAFE, *Burma.

Studies of 15 floods in the middle and lower Irrawaddy River, Burma indicated that all widespread floods were associated with rainstorms in the monsoon trough of at least 3 days duration. Because the northern part of the country is a mountainous region it appears that the active monsoon trough effect was added by the orographic effect, thereby producing intense rainstorms favoring formation of floods in the middle and lower Irrawaddy catchments. For major floods the lag time between the end of significant rain in the head-water regions and the time of occurrence of peak at Henzada was about 15 days. Forecasting of floods along middle and lower Irrawaddy by using known meteorological conditions in the head-water regions of Chindwin and Upper Irrawaddy appears to have advantages over any of the existing methods because preliminary warning can be issued well in advance. (Knapp-USGS)
W71-04165

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
Drainage and Irrigation Dept., Kuala Lumpur (Malaysia). Research Station.
For primary bibliographic entry see Field 02B.
W71-04167

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
Pakistan Meteorological Dept., Karachi. Central Secretariat.
For primary bibliographic entry see Field 02B.
W71-04168

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
Regional Meteorological Center, Lahore (Pakistan).
For primary bibliographic entry see Field 02B.
W71-04169

SNOWMELT AND WATER YIELD FROM SNOW COVER,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W71-04171

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOW-MELT PERIOD,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W71-04172

SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02C.
W71-04173

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
Meteorologischer Dienst der Deutschen Demokratisches Republik, Halle. Amt fuer Meteorologie.
For primary bibliographic entry see Field 02C.
W71-04174

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
Research Inst. of Amelioration, Prague (Czechoslovakia).
For primary bibliographic entry see Field 02C.
W71-04175

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Moscow (USSR).
N. S. Nechaeva, and L. S. Kuchment.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 663-671, 1969. 9 p, 2 fig, 14 ref.

Descriptors: *Flood forecasting, *Computer programs, *Routing, *Unsteady flow, Streamflow forecasting, Hydrograph analysis, Water storage, Reservoirs, Discharge (Water), Peak discharge, Gaging stations, Stream gages, Analog computers, Digital computers.
Identifiers: Volga River System (USSR).

For lack of hydrological and morphometric information it is difficult to use hydrodynamical methods of unsteady flow calculation in developing practical methods of routing flood waves on large river systems. At the same time this information is sufficient for the application of engineering methods making it possible to demonstrate the general scheme of flood wave movement along the river system without detailing complicated processes occurring on some river stretches. Such methods include those which are based on the use of Duhamel's integral and on the relation of discharges and volumes. Parameters needed for the use of these methods can be determined by means of observations of the hydrological regime. When using engineering methods of routing of unsteady flow it is convenient to select empirical parameters with the help of electronic analog computers. These methods were used in developing the scheme of flood wave computation and forecast for the complex river system of Volga--Kama--Vyatka which has more than twenty inlet gaging sections. This system has been programmed for electronic computer and is used for daily issues of short-term forecasts during the period of floods. A timely

forecast is ensured by the natural time of travel from the inlet gaging sections of the system to the outlet. (Knapp-USGS)
W71-04176

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
J. A. Zhelesniak, and L. B. Byshovets.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 681-688, 1969. 8 p, 3 fig, 1 tab, 2 ref.

Descriptors: *Flood forecasting, *Snowmelt, *Routing, Runoff forecasting, Streamflow forecasting, Frequency analysis, Hydrographs, Hydrograph analysis, Water yield, Peak discharge.
Identifiers: Isochrone method, USSR, Ukraine.

Flood forecasting by the genetic formula of runoff used in the USSR is preceded by the determination of water yield variation, distribution of areas between isochrones, and channel capacity. Water yield variation is determined by the runoff hydrograph of a small river by means of runoff retransformation within interisochrone areas. The distribution of areas between isochrones is found by using data on the length and area of catchments for the first order tributaries upstream of the given outlet, and lag time from the head to this outlet. The lag time is estimated by channel capacity, which can be determined by topographic measurements or by standard graphs depending on river length and discharge in the design outlet. Such graphs were constructed for different types of small rivers of the Ukraine. The suggested calculation method allows determination of the ordinates of a hydrograph of very rare frequency. (Knapp-USGS)
W71-04178

ANALYSIS OF SNOW MELT FLOODS,
Public Works Research Inst., Tokyo (Japan).
T. Kinosita, S. Aoki, and K. Ishizuka.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 645-655, 1969. 11 p, 9 fig.

Descriptors: *Snowmelt, *Water yield, *Floods, *Small watersheds, *Investigations, Snow surveys, Moisture meters, Instrumentation, Runoff, Overland flow, Streamflow, Meteorology, Infiltration, Mapping, Energy budget.
Identifiers: Japan.

The Public Works Research Institute of Japan carried out research on forecasting of snowmelt floods from 1956 to 1965 at Yuzawa, Niigata Prefecture, in the temperate zone. The study watershed's catchment area is 147 sq km. The water equivalent, depth of snow, and the amount of snowmelt were measured by means of gamma-ray moisture meters. Estimating the total amount of snow on the basin at the end of winter, the mechanism of latent heat transferred into the snow layer, and the path of snowmelt water into small brooks are studied in detail in a smaller research watershed of 8.35 sq km. (Knapp-USGS)
W71-04179

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
For primary bibliographic entry see Field 02C.
W71-04180

A SIMPLE CASCADE WATERSHED MODEL,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02A.
W71-04181

2F. Groundwater

EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
Anil Kumar, and Oscar K. Kimbler.
Water Resources Research, Vol 6, No 6, p 1689-1700, December 1970. 12 p, 9 fig, 3 tab, 11 ref. OWRR Project A-002-LA (6).

Descriptors: Water storage, *Underground storage, *Saline water systems, *Mixing, *Density stratification, Injection, Injection wells, Withdrawal, Groundwater movement, Diffusion, Dispersion, Flow, Stratified flow, Model studies, Hydraulic models, Aquifers, Artificial recharge.
Identifiers: *Underground water storage.

A CALCULATION PROCEDURE HAS BEEN DEVISED, USING EXISTING ANALYTICAL AND EMPIRICAL RELATIONSHIPS, TO PREDICT MIXING AND GRAVITATIONAL SEGREGATION IN A HORIZONTAL RADIAL FLOW SYSTEM. The procedure yields results that show excellent agreement with experimental results obtained with a three-dimensional laboratory flow model in which both mixing and gravitational segregation occur simultaneously. Thus validated, the calcuation procedure was applied to the prediction of the efficiency with which freshwater stored in saline aquifers might be recovered for later use. Low aquifer water salinity, low formation permeability, and low formation thickness lead to the most favorable recoveries. The calculation procedure indicates that recovery efficiency improves with the number of injection-production cycles, thus suggesting that even for unfavorable conditions the process might become feasible on a long-term basis. Graphical presentations show the relative importance of several pertinent variables including formation stratification. (Knapp-USGS)
W71-03870

OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
Mass Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 04B.
W71-03919

UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Ralph R. Marlette, and Leon S. Directo.
Available from NTIS as PB-197 117, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report (1970). 15 p, 2 tab, 4 fig, 3 ref. OWRR Project A-011-NEB (1).

Descriptors: *Aquifer, *Groundwater, *Infiltration, Recharge, River quality, Water supply, Nebraska, *Artificial recharge.
Identifiers: Platte River.

The project objective was to determine the feasibility of recharging the Platte Valley Aquifer using river water infiltrated through basins. The operating problems were found to be formidable. Phase I of the study was a water quality survey of the Platte and Elkhorn Rivers. The river discharges were lower than normal and no floods occurred during the periods of sampling. Phase II consisted of an evaluation of the aquifer and preliminary recharge tests. The average transmissibility of the aquifer was 190,000 gpd/ft and the storage coefficient was 0.17. Since the water table was only 10 to 12 feet below the surface, pumping was required to lower the water level to provide storage for the recharge water. Phase III was the operation of the recharge facilities. After completion of the system in August, 1968, there was no water at the intake because of the low river stage.
W71-03924

AVAILABILITY OF GROUNDWATER I WESTERN COWLITZ COUNTY, WASHINGTON,
Geological Survey, Tacoma, Wash.
D. A. Myers.
Report available from Wash State Dept of Ecology Airdustrial Park, Olympia, Wash - Price $2.00 Washington Department of Ecology Water-Suppl Bulletin No 35, 1970. 63 p, 7 fig, 2 plate, 7 tab, 1 ref.

Descriptors: *Water resources, *Groundwater *Washington, *Water wells, *Hydrologic data Data collections, Aquifers, Water quality, Chemical analysis, Water levels, Water table, Water leve fluctuations, Water yield, Drawdown, Pumping Withdrawal, Streamflow, Discharge measurement Flow rates, Hydrographs, Specific capacity Logging (Recording), Surface-groundwater relationships.
Identifiers: *Groundwater resources, *Cowlitz County (Washington).

Wells in Cowlitz County, Washington, produce water from Tertiary sedimentary and igneous rock and Holocene alluvial materials. The wells range in depth from less than 6 to more than 600 feet, and yields from these wells range from less than 1 to more than 3,000 gpm. A wide variation in yields from alluvial aquifers is due primarily to the percentage of clay and silt they contain. Wells near the Columbia River tap the most productive of alluvial aquifers. Water levels in these wells show a response to river stage that is almost immediate and of the same general magnitude as the range in tidal stage of the river. Groundwater use in some parts of Cowlitz County is limited by the quality of the water. Observed dissolved-iron concentrations range from zero to 36.0 mg/l, and undesirable concentrations are common in the densely populated areas. In most other respects, the chemical quality of the groundwater is generally good. (Woodard-USGS)
W71-03934

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
Geological Survey, Austin, Tex.
James T. Smith.
Texas Water Development Board Report 119, July 1970. 115 p, 10 fig, 8 tab, 22 ref.

Descriptors: *Groundwater, *Water wells, *Hydrologic data, *Data collections, *Texas, Water levels, Water quality, Water yield, Aquifer characteristics, Springs, Water utilization, Water consumption (Excludes consumptive use), Municipal water, Irrigation water, Industrial water, Stock water, Domestic water, Water sources, Chemical analysis, Pumping, Drawdown, Logging (Recording).
Identifiers: Collingsworth County, Tex.

An inventory of approximately 1,100 water wells and springs in Collingsworth County, Texas includes all public supply, irrigation, and industrial wells, and a representative number of domestic and livestock wells. The principal aquifers are the Blaine Formation of Permian age and the alluvial plain, terrace, and channel deposits of Quaternary age. The Blaine Formation yields small to large quantities of saline water (494 to 4,482 milligrams per liter of dissolved solids) to wells and is capable, in places where solution cavities are interconnected, of yielding more than 1,000 gallons per minute. Although the water is of poor quality, the Blaine is the major source of irrigation water in the county. The Quaternary alluvium yields small to large quantities of water that is generally low in dissolved solids, and is the major source of water for municipal supply. Water levels in the aquifers have remained generally steady since about 1938, except in a few areas of concentrated pumpage for irrigation. The major water quality problems in Collingsworth County are the concentrations of dissolved solids, sulfate, chloride, and sodium. No evidence was found of groundwater pollution from oil-field brines. (Woodard-USGS)
W71-03935

OLOGY AND GROUNDWATER SOURCES OF ALLEN COUNTY, KANSAS,
nsas State Geological Survey, Lawrence.
n E. Miller.
nsas Geological Survey Bulletin 195, December 59. 50 p, 14 fig, 1 plate, 5 tab, 63 ref.

scriptors: *Groundwater, *Water wells, *Water ources, *Geology, *Kansas, Hydrologic data, ter quality, Aquifers, Aquifer characteristics, gging (Recording), Data collections, Water els, Sediments, Water table, Springs, Water ld, Hydrogeology, Chemical analysis, Water ization, Drawdown, Pumping, Specific capacity. ntifiers: *Groundwater hydrology, Allen Coun- Kansas.

en County, Kansas, lies within the Osage Plains tion of the Central Lowlands physiographic vince and includes an area of about 504 square es. Rocks above the Precambrian basement e an average thickness of about 2,000 feet and all sedimentary in origin. The consolidated posits range in age from Cambrian through nsylvanian, and the unconsolidated deposits ge in age from probable Tertiary through aternary. The most important bedrock aquifers the shallow Pennsylvanian limestones and sand- nes that have been weathered along joints, frac- es, and bedding planes. Potable groundwater is ally not found in the county below the base of Kansas City Group, and in many places the ndary between fresh and saline water is much her in the stratigraphic section. Alluvial deposits ing an average thickness of about 25 feet in the osho River valley should yield 10 to 100 gallons minute of groundwater to wells. Water from the aternary deposits is of good quality but is usually y hard. Water derived from shallow bedrock ifers is generally higher in dissolved solids con- t and hardness than water from the Quaternary posits. (Woodard-USGS)
1-03937

E OF PORE CASTS AND SCANNING ELEC- ON MICROSCOPE TO STUDY PORE OMETRY,
n American Petroleum Corp., Tulsa, Okla. search Center.
primary bibliographic entry see Field 07B.
1-03946

MOTE GROUNDWATER LEVEL METER R BOG STATIONS,
primary bibliographic entry see Field 07B.
1-03966

MPUTER AIDS GROUNDWATER SOURCES RESEARCH PROJECT,
zona Univ., Tucson. Dept. of Agricultural En- eering.
G. Matlock, and P. R. Davis.
gressive Agriculture in Arizona, Vol 22, No 5, t-Oct 1970, p 3-5. 4 fig.

scriptors: *Computer programs, *Groundwater, igital computers, *Water resources, *Data col- tions, Data processing, Data storage and rieval, Water level fluctuation, Withdrawal, ps, Consumptive use, Wells, Logging (Record-), Contours, On-site data collections, Depth, search equipment, Measurement, Surveys. ntifiers: *Data bank, Printout, Punchcards.

ital computer programs were written to meet undwater resources research requirements ause of prompt data storage and retrieval, ful- ment of data-user needs, mapping possibilities l adaptability. Groundwater research in the ricultural Engineering Department of the iversity of Arizona began in the early 1900's, as importance of groundwater to Arizona was ognized early. Thus, there are records for over years of field work. Basic groundwater data col- ted periodically includes water-level measure- nts, pumpage and consumptive use inventories, nestic and industrial use measurements, water quality, sampling chemistry and temperature, maintenance of drillers' well logs and specialized studies. The Santa Cruz Valley from Nogales to Picacho Peak, the Avra and Altar Valleys and Lit- tle Chino Valley are presently under study. Preparation of yearly groundwater contour and water-level change maps, which used to take several months, is now done by computer program. Data is card-punched, and programs print out ta- bles for office and inquiry use, hydrographs and crop-survey summaries. Programs make ground- water information available, with considerable error reduction, for class projects, graduate theses, consulting engineers, groundwater geologists, real estate agents, water users and government agen- cies. Some of the computer output may be used directly in publication. (Popkin-Arizona)
W71-04057

NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
California Univ., Berkeley.
For primary bibliographic entry see Field 07B.
W71-04110

GEOHYDROLOGIC BOUNDARY ENVELOPES,
Department of Energy, Mines and Resources, Col- gary (Alberta). Inland Waters Branch; and Research Council of Alberta, Edmonton.
D. H. Lennox, and A. Vandenberg.
Journal of Hydrology, Vol 12, No 1, p 48-52, December 1970. 5 p, 2 fig, 2 ref.

Descriptors: *Groundwater movement, *Draw- down, *Unsteady flow, Mathematical studies, Transmissivity, Storage coefficient, Observation wells, Water wells.
Identifiers: *Envelopes (Mathematical), *Aquifer testing, *Pumping tests, *Theory of images.

Analysis of drawdown data for an observation well in a semi-infinite aquifer gives a one-parameter family of straight lines, each of which, in the absence of supplementary geologic or hydrologic evidence, defines a possible boundary location. The curve to which all members of the family are tangent is an ellipse and is called to geohydrologic boundary envelope. This ellipse may be useful in considering the significance of nonresponsive ob- servation wells or in using supplementary geologic data to determine the position of a boundary. (K- napp-USGS)
W71-04125

FINITE AQUIFERS: CHARACTERISTIC RESPONSES AND APPLICATIONS,
C. Venetis.
Journal of Hydrology, Vol 12, No 1, p 53-62, December 1970. 10 p, 5 fig, 3 tab, 3 ref.

Descriptors: *Groundwater movement, *Water level fluctuations, *Simulation analysis, *Input- output analysis, Mathematical models, Numerical analysis, Synthetic hydrology, Water levels, Equa- tions, Flow, Porous media, Analog models, Aquifers.
Identifiers: Finite aquifers.

The response to characteristic piezometric height inputs of aquifers of finite dimensions is examined using linear differential equations of groundwater flow. In practical applications the response to characteristic inputs may be used in input-output analysis and synthesis for prediction of piezometric heights and estimation of the parameters of aquifers as well as in setting up and testing ground- water analog models. Such applications are illus- trated by a simple numerical example. (Knapp- USGS)
W71-04126

ANALYTICAL SOLUTION OF THE LAPLACE EQUATION IN REGIONAL GROUNDWATER FLOW FIELD,
Arya Mehr Industrial Univ., Tehran (Iran). Dept. of Mechanical Engineering.
Mohsen Shahbazi.
Text also in French. Journal of Hydraulic Research, Vol 8, No 4, p 457-476, 1970. 20 p, 17 fig, 12 ref.

Descriptors: *Groundwater movement, *Laplaces equation, Porous media, Permeability, Model stu- dies, Mapping, Hydraulic models, Least squares method, Flow nets, Aquifers, Groundwater basins.
Identifiers: Groundwater flow fields.

The Laplace equation was solved analytically for single and multi-layered systems in a regional groundwater flow field with the aid of conformal mapping and separation of variables. The results for one layered system were checked with laborato- ry experiments using the Hele-Shaw model. Also for multi-layered systems and for some single- layered ones, the results were shown to be in good agreement with another independent method of solution using the least-square method. (Knapp- USGS)
W71-04130

THE PUMPED WELL,
Colorado Agricultural Experiment Station, Fort Collins.
For primary bibliographic entry see Field 04B.
W71-04292

2G. Water in Soils

ADSORPTION OF BORON BY FERROMAGNE- SIAN MINERALS AND MAGNESIUM HYDROX- IDE,
Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
J. D. Rhoades, R. D. Ingvalson, and J. T. Hatcher.
Soil Science Society America Proceedings, Vol 34, No 6, p 938-941, November-December 1970. 4 p, 1 fig, 5 tab, 10 ref.

Descriptors: *Soil chemistry, *Boron, *Adsorp- tion, *Soils, Magnesium hydroxide, Leaching, Clays, Silts, Sands, Clay minerals, Particle size, Chemical analysis, Soil water, Profiles, Silicates, Soil properties, Test procedures, Methodology, Temperature, Mineralogy, X-Ray diffraction.
Identifiers: *Ferromagnesian minerals.

Arid-zone soils are found to have appreciable boron-sorption capacities in their silt and sand frac- tions. The site of this sorption is hypothesized to be magnesium-hydroxy clusters and coatings that exist on the weathering surfaces of ferromagnesian minerals such as olivine, enstatite, diopside, augite, tremolite, and hornblende as well as micaceous layer-silicate minerals. The boron-adsorption capacities of the nine soils used were determined by evaluating the Langmuir adsorption coefficients of the soils after their native sorbed boron had been removed by extraction with a mannitol-calcium- chloride solution and after they had been separated into particle-size fractions. Data for a representa- tive soil show that out of the soil's total boron-sorp- tion capacity of 10.8 mg/kg, 7.7 mg/kg reside in the non-clay fraction. The percentages of boron-sorp- tion capacity residing in the non-clay fractions ranged from 25 to 90. Thus, it is apparent that soils may contain minerals other than clay-sized minerals with their associated iron- and alluminum- hydroxy coatings that are capable of sorbing ap- preciable amounts of boron. (Woodard-USGS)
W71-03939

PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agronomy.
Wayne N. Dankert, and James V. Drew.
Soil Science Society America Proceedings, Vol 34, No 6, p 916-919, November-December 1970. 4 p, 2 tab, 27 ref.

Descriptors: *Soil chemistry, *Clay loam, *Zinc, *Soil tests, *Nebraska, Distribution, Particle size,

Testing, Soil moisture, Test procedures, Soil profiles, Soil structure, Methodology, Spectrophotometry, Chemical analysis, Fine-textured soils, Carbonates, Organic matter, Silts, Plants, Sands, Adsorption, Loess, Mineralogy.
Identifiers: *Zinc distribution (Soils), Clay illuviation, Soil genesis.

The distribution of total Zn in a Udic Haplustoll (Moody) and a Typic Argiustoll (Holdrege) formed in Peoria loess in Nebraska is related to the accumulation of illuvial clay in these soils. In Typic Ustorthents (Crofton and Coly) formed in Peoria loess, a comparable distribution of noncarbonate clay and total Zn does not occur. Larger amounts of Zn in noncarbonate clay from the upper sola of the four profiles, than in noncarbonate clay from their C horizons, suggest that Zn is released from soil minerals and cycled by vegetation during biopedogenic weathering, then becomes associated with noncarbonate clay in the A horizons following decomposition of plant residues. In Moody and Holdrege, however, maximum amounts of Zn in the total soil occur in the B horizons of clay maxima, suggesting that Zn moves in association with clay from the A to the B horizons during the genesis of these soils. (Woodard-USGS)
W71-03940

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. M. Hasan, R. L. Fox, and C. C. Boyd.
Soil Science Society America Proceedings, Vol 34, No 6, p 897-901, November-December 1970. 5 p, 6 fig, 5 tab, 24 ref.

Descriptors: *Soil chemistry, *Sulfates, *Sorption, *Soils, *Hawaii, Soil water, Solubility, Retention, Adsorption, Ionization, Anion exchange, Sulfur, Rain water, Plants, Fertilizers, Solubility, Chemical analysis, Rainfall, Soil properties, Mineralogy, Test procedures, Turbidity, Soil-water-plant relationships, Soil profiles, Crop response.
Identifiers: *Volcanic ash soils (Hawaii), Sulfate adsorption, Kikuyu grass.

The capacity of volcanic ash soils to adsorb sulfate is related to rainfall, a major factor in weathering. Highly weathered and leached soils developed from ash may contain 7000 micrograms per gram of sulfate as sulfur in the subsoil. This sulfate has very low water solubility. Some less weathered ash soils are almost devoid of sulfates. Desorption of sulfate decreases the solubility of adsorbed sulfate remaining. Sulfate sorption-desorption isotherms plotted against log concentration of sulfate in equilibrium solutions give approximately straight lines up to 16 to 30 ppm sulfur in solution. Indications are that 'first phase' adsorption maxima were attained at about 33 ppm sulfur in solution. Pot studies on soils which sorb much sulfate indicate that the soil solution should contain about 5 ppm sulfate for adequate nutrition of kikuyu grass. This corresponds to 60 to 80% of first phase adsorption maxima of the ash derived soils. Soils which have low capacity to adsorb sulfate need higher concentrations of sulfate in solution to compensate for low adsorption capacity. A soil which field experiments had shown to be very deficient in sulfur was only 10% sulfate saturated. (Woodard-USGS)
W71-03941

THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
Kentucky Univ., Lexington. Dept. of Agronomy.
J. H. Ellis, R. I. Barnhisel, and R. E. Phillips.
Soil Science Society America Proceedings, Vol 34, No 6, p 866-870, November-December 1970. 5 p, 5 fig, 1 tab, 13 ref.

Descriptors: *Soil chemistry, *Clay minerals, *Diffusion, *Cation adsorption, *Soil water, Diffusivity, Copper, Manganese, Illite, Kaolinite, Montmorillonite, X-ray spectroscopy, Equations, Theoretical analysis, Ionization, Ions, Adsorption, Plants, Root systems, Mineralogy.
Identifiers: Diffusion coefficients, Zinc.

The distributions of Cu, Mn, and Zn diffusing in thin oriented clay films of water-saturated montmorillonite, vermiculite, illite and kaolinite were obtained using a miniature probe attachment for an X-ray emission spectrometer. Diffusion coefficients were calculated from these experimental distributions. Only small differences in the diffusion coefficients of Cu, Mn, and Zn at comparable concentrations were found for a given clay. The range of diffusion coefficients for copper chloride was 0.17 millionths of a sq. cm. per sec. of vermiculite clay to 5.21 of kaolinite. The diffusion rates of copper, manganese, and zinc through the clay minerals were of the order from greatest to least: kaolinite, illite, montmorillonite, and vermiculite. Some estimates of the diffusion coefficients in the liquid phase and in the adsorbed phase are given. (Woodard-USGS)
W71-03942

INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
A. A. Kapotov.
Translated from Trudy Gos Gidrol Inst-ta, No 176, p 70-107, 1969. Soviet Hydrology: Selected Papers, No 5, p 456-479, 1969. 24 p, 8 fig, 9 tab, 23 ref, 3 append.

Descriptors: *Soil moisture, *Freezing, *Thawing, *Soil physical properties, *Soil water movement, Filtration, Percolation, Frost, Snowpacks, Regime, Porosity, Moisture content, Water storage, Bulk density, Surveys, Data collections, Hydrologic data.
Identifiers: *USSR, *Valdai Hydrologic Laboratory (USSR).

Extensive data have been collected by the Valdai Laboratory of some water-physical properties of soils, their water regime, depth of freezing, and filtration properties for a relatively large area of the USSR. The area where the Laboratory made its investigations is a morainic landscape with hills, ridges, and waterlogged depressions. Dry valleys occupy an average of 80% of the total catchment areas. The surface of the catchments is composed of a layer of Quaternary glacial deposits 20-50 m thick. The lithological composition varies both in the horizontal and vertical directions. The soil hydrophysical data are summarized graphically and statistically. Graphs relate bulk density to moisture content, water storage distribution to depth, texture to physical property, freezing depth to snow depth, and absorption of depth. Tabular data include porosity, moisture content, water storage, freezing depths, snow cover, absorption and filtration characteristics, bulk density, and annual water storage records. (Knapp-USGS)
W71-03964

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-04000

DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
Bureau of Reclamation, Denver, Colo.
V. E. Rainin, and E. A. Makarycheva.
Translated from: Gidrotekhnika i Melioratsiya No 1, p 34-48, 1965. Available from NTIS as PB-193 618T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 686, April 1967. 11 p, 2 fig, 1 tab.

Descriptors: Water, *Permeability, Soils, S mechanics, Soil moisture, Soil physical properti Field tests, Seepage, Test procedures, Grou water, Velocity, Measurement, Neutron counte Meters, Observation wells, Drill holes, Wet con tion.
Identifiers: Seepage rings method, *Wetting fro Foreign, Research, USSR, Soil moisture mo ment, Golodnaia Steppe (USSR).

USSR hydraulic engineers have checked an Am ican method for determining soil permeability a seepage rates by large concentric rings and reco mended its use because of its reliability, especia in layered soils. Other advantages of this meth are that it uses Nesterov's principles for la wetted surfaces, familiar to Soviet soil specialis the test arrangement is simple to set up and me surements are made easily; and it is capable of a tomation. Disadvantages are the longer ti required for observations and the large quantity water used. Seepage measurements were co ducted on several test plots in the Golodn Steppe of Central Asia over a 3-year period. T 2.6-m-dia metal inner ring set in a 10-cm furr and the 7.8-m-dia earth outer ring faced wi polyethylene film automatically were kept fill with water to a constant depth of 30 cm. S moisture was measured by neutron meters insert into observation drill holes. Before-and-after me surements permitted fixing changes in the positi of the wetting front, and with time, computing t wetting and seepage rates horizontally and ver cally. Tests showed that wetting rate was at fi greater than seepage; but later they became a proximately equal and the curves became fl slopes, indicating a stable seepage rate.
W71-04006

DRAINAGE LINE DEPTH,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08D.
W71-04016

IMPROVING EFFICIENCY IN AGRICU TURAL WATER USE,
Colorado State Univ., Fort Collins. Natur Resources Center.
For primary bibliographic entry see Field 03C.
W71-04049

SOME ASPECTS OF THE GEOMORPHOLOG OF THE AIR MOUNTAINS, SOUTHER SAHARA,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. Geography.
M. B. Thorp.
Institute of British Geographers, Transactions, N 47, p 25-46, September 1969. 12 fig, 33 ref.

Descriptors: *Geomorphology, *Deserts, *A gradation, *Canyons, *Land forming, Arid land Superimposed drainage, Drainage density, Geolog ic time, Mountains, Regions, Slopes, Sedimentar basins (Geological), Structural geology, Topog raphy, Volcanoes, Weathering, Water gaps, On-si investigations, Geological surveys, Sediment Stratigraphy, Tropical regions, Erosion, Tertiar Period, Granites, Crystalline rocks, Elevatio Rainfall, Vegetation, Temperature, Lava, Sedimen tary rocks, Environmental effects, Sandstone Deformation, Paleoclimatology, Paleohydrology Mode of action, Mineralogy, History, Pleistocen Epoch, Terraces (Geological), Gravels, Climates.
Identifiers: *Air Mountains, *Sahara Deser *Niger, *Planation surfaces, *Massifs, Morphoch matic aspects, Pluvial effects, Pediplanation, Reg Escarpments, Tectonic granites, Gneisses, Wadi Climatic effects, Outcrops.

The Air Mountains are remote mountain 'islands of the Sahara and contain many features of con siderable geological and geographical interest hid den, unfortunately, by their isolation. The thre salient geomorphological features of the region ar planation surfaces, morphology, of the Jurassic

ite massifs and pleistocene aggradational land
s. The author feels that despite criticism of the
utionary approach to landform analysis, it may
seful and valid in this region. The climate, re-
nd drainage patterns of the area are discussed.
itic and metamorphic crystalline basement
s are surrounded by Carboniferous to
aceous sediments and are frequently overlain
nd-Cretaceous lavas. Much evidence suggests
the crystalline rocks were buried during the
aceous marine transgression. The major koris
lis) are discordant to the crystalline and in one
on the koris from the crystalline area cut
ugh the sedimentary scarplands as consequent
ms in water gaps. The dominant feature of the
s a planation surface having a relative relief of
00 m. The main Air surface is Tertiary in age
e the summit surface is either Cretaceous or
eocene. The differential erosion of various
ites in the Timia Jurassic granite ring complex
nphasized and it appears that these processes
imilar to those of the now humid Nigerian mas-
Tertiary denudation in the 2 regions was
ably similar and Tertiary climates in the
nern Sahara were probably more humid than
Climate was also important in the formation
leistocene aggradational landforms. It is felt
the opening and closing phases of pluvial
ods produced phases of kori incision and ag-
ation. (Casey-Arizona)
-04050

IE PROBLEMS OF A KARST AREA IN THE TERN TRANSVAAL, SOUTH AFRICA,
ersity of the Witwatersrand, Johannesburg
th Africa). Dept. of Geography.
garet E. Marker.
tute of British Geographers, Transactions, No
73-85, July 1970. 6 fig, 3 tab, 18 ref.

criptors: *Karst, *Geomorphology, *Drainage
ts, *Dolomite, *Sedimentary structures, On-
investigations, Seepage, Alluvium, Terraces
logical), Basins, Weathering, Valleys, Mode
ction, Sedimentary rocks, Stratigraphy, Ero-
Chemical analysis, Calcium, Magnesium, Ru-
Bedrock, History, Caves, Slopes, Land form-
Geologic time, Environmental effects,
tocene Epoch, Interfluves, Geologic forma-
.
tifiers: *South Africa, *Transvaal, *Relict
tures, Hythergraphs, Intrusions.

geomorphology of certain areas of the Pre-
brian Dolomites of the Transvaal system of
h Africa suggest the operation of karst
esses. In describing the karst topography, 3
nct aspects of the landscape are considered:
origin and shape of the conical dolomite hills
d along the interfluves which seem to be a
of Kegel karst, (2) the wide, flat-floored val-
which were probably formed by lateral
ing of springs, floods or runoff and (3) the
nentary infill of the valleys which form ter-
s of highly weathered alluvial deposits and
h are considered relicts. The interfluves are
niscent of cone karst and the basins represent
rst plain with insoluble floors, some fault con-
and a deep alluvial infill. Degraded slopes, col-
ed caves and rotten infill combine with the
r evidence to suggest that past processes
ted the land forms which may be described as
t karst. Probably active karstification occurred
ng warmer, more humid periods of the
tocene. (Casey-Arizona)
-04053

IERALOGY OF SOME ARID AND HARID LAND SOILS OF IRAQ,
consin Univ., Madison. Geological and Natural
ory Survey.
I. Al-Rawi, M. L. Jackson, and F. D. Hole.
Science, Vol 107, No 6, June 1969, p 480-486.
, 5 fig, 24 ref.

criptors: *Mineralogy, *Sierozems, *Soil analy-
*Soil formation, *Alluvium, *Soil water, Mont-
morillonite, Crop production, Deserts, Arid lands, Arable land, Brown soils, Soil physical properties, Hydraulic conductivity, Clays, Quartz, Sands, Silts, Particle size, Land development, Terraces (Geological), Semiarid climates, Pleistocene Epoch, Quaternary Period, Fine-texture soils, Soil types.
Identifiers: *Iraq, *Semiarid lands, *Land use capabilities, Haplargrid soil, Torrifluvent soil, Xerothermic interval, Quaternary pedology, Holocene alluvium, Feldspars.

Deserts, widespread during the Xerothermic Interval (6000 to 4000 yrs. B.P.), occupy a third of the earth's land area, including most arable land of Iraq. Understanding the composition of these soils is important for advances in Quaternary pedology and for food production in arid lands. This quantitative mineralogical analysis of one Haplargid (Brown) soil (Pleistocene terraces of northern Iraq), and three Torrifluvent (Alluvial) soils (stratified, fine textured Holocene alluvium of north and central Iraq) provides a means of understanding soil formation and properties, and land use capabilities (alkalinity, nutrients, salinity). Montmorillonite, important to hydraulic conductivity, is the dominant clay, the remaining minerals being mica, vermiculite, quartz, feldspars and stratified silicates with chlorite and mica. Quartz is the dominant sand and silt mineral, the remainder being albite, microcline, mica, vermiculite, chlorite, montmorillonite, and traces of serpentine, amphibole, sepiolite, palygorskite and kaolinite. Mineral ratios are discussed. Quartz and feldspars decrease, while montmorillonite, mica and vermiculite increase with decreasing particle size. Haplargid and two Torrifluvent surface horizons had uniform mineralogy. Tables include soil formation factors of some great soils and feldspar contents and ratios. Figures show soil locations, sand and soil mineralogy and X-ray diffractograms of clay and mica. (Popkin-Arizona)
W71-04061

SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
Technion--Israel Inst. of Tech., Haifa.
Dan Zaslavsky.
Soil Science, Vol 107, No 3, March 1969, p 160-165. 5 fig, 9 ref, 15 equations.

Descriptors: *Saturated flow, *Unsaturated flow, *Infiltration, *Soil water movement, *Flow resistance, Hydraulic conductivity, Flow profiles, Groundwater, Interfaces, Infiltrometers, Soil surfaces, Reservoir leakage, Artificial recharge, Resistance, Arid lands, Equations, Flow rates, Pressure head, Soil physical properties, Permeability, Depth, Measurement, Control.
Identifiers: *Control surface layer, *Vertical flow, 2-dimensional flow, 3-dimensional flow, Water head, Circumference buffering, Infiltration ring.

Transition from saturated to unsaturated flow, flow profile analysis with depth to groundwater, and hydraulic conductivity as a depth function were studied. Groundwater does not influence the infiltration rate unless it comes very near the interface between layers. Infiltration rate is proportional to ponded water head only at high heads. With a control surface layer, infiltration ring measurements need no circumference buffering to preserve vertical flow. It is necessary that the ring walls be pushed through the less permeable surface layer. Infiltration rate is unaffected by the flow divergence below the control layer. When the top layer is much more permeable, it is impossible to form a vertical downward flow under a limited infiltration area, and the overall infiltration rate will decrease with increase in wetted soil surface. The control layer concept can be qualitatively extended to 2 and 3 dimensional flow. Flow resistance along a stream tube decreases with increased distance from point of entry. One figure enables one to define some equivalent flow resistance layer and an equivalent hydraulic conductivity. This approach is useful for evaluating reservoir leakage with complex topography and for computing infiltration rates in areas of artificial groundwater recharge. Figures show pressure head and distribution in unsaturated flow, transition heads, experimental and theoretical infiltration rates, and unsaturated soil portion as a head function. (Popkin-Arizona)
W71-04066

MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 05B.
W71-04067

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
Agricultural Research Service. Northern Plains Branch; and Nebraska Univ., Lincoln. Agricultural Experiment Station.
Fred A. Norstadt, and T. M. McCalla.
Soil Science, Vol 107, No 3, March 1969, p 188-193. 4 tab, 2 fig, 13 ref.

Descriptors: *Stubble mulching, *Bacteria, *Fungi, *Nebraska, *Microorganisms, Wheat, Actinomycetes, Crop production, Soil moisture, Erosion, Permeability, Drainage, Root zone, Loess, Sampling, Cultivation, Rotations, Soil microbiology.
Identifiers: *Microbial populations, *Subtilling, *Penicillium, *Trichoderma, *Patulin, Residues, Semiarid lands.

The purpose of this paper is to consider the numbers of Penicillium urticae Bainier and Trichoderma sp. P. urticae B., total bacterial and fungal counts, and patulin amounts in stubble-mulched soil at three east-to-west locations across Nebraska. Soil samples were obtained from Lincoln, North Platte and Alliance, Nebraska. Soils at the sites were on Peorian loess and have deep root zones, good internal and surface drainage, and moderate permeability. Rotations were established to study stubble mulching in relation to erosion, moisture storage and crop yields. Subtilling increased total bacterial actinomycetes and fungi. P. urticae B. numbers increased in subtilled compared with plowed soil or with subtilled soil with removed crop residue. Subtilling did not increase Trichoderma sp. Growth of associated microorganisms changed wheat straw into a favorable substrate for P. urticae B. P. urticae B. numbers were highest in spring and fall, and lowest in summer in subtilled soil, whereas Trichoderma sp. numbers were reversed in this trend. The anatagonism of P. urticae B. to Trichoderma mediated by patulin could cause this inverse trend. Patulin was detected in field samples at 1.5 ppm in soil and 40 to 75 ppm in wheat straw residue. Yield reduction with subtilling could be partially due to patulin production. Tables and figures quantify these relations. (Popkin-Arizona)
W71-04068

SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
Regional Inst. of Tech., Jamshedpur (India). Dept. of Applied Mechanics.
S. V. Kameswara Sarma.
Text also in French. Journal of Hydraulic Research, Vol 8, No 4, p 477-492, 1970. 16 p, 4 fig, 2 tab, 4 ref.

Descriptors: *Hydraulic models, *Soil water movement, *Hydraulic similitude, Saturated flow, Unsaturated flow, Seepage, Model studies, Mathematical studies, Capillary action, Diffusivity, Canal seepage, Dams.
Identifiers: *Partially saturated flow.

Linear scale ratios were established for partially saturated steady and unsteady states of flow in soils. These deductions were verified for two-dimensional flows through earth dams and canals. The results obtained from experimental investiga-

tion on graded sand models agree closely with theoretical deductions made for steady flow phenomena. They differed for unsteady saturated fronts because diffusivity was not simulated to scale. (Knapp-USGS)
W71-04131

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
Atomic Energy Research Establishment, Wantage (England). Research Lab.; Water Resources Board, Reading (England); and Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 02A.
W71-04138

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02D.
W71-04242

HALF-MINUTE COUNTS FOR NEUTRON PROBES,
Forest Service (USDA), Fayetteville, Ark. Southern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W71-04259

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02J.
W71-04260

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02J.
W71-04261

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
North Dakota State Univ., Fargo. Dept. of Soils.
For primary bibliographic entry see Field 03F.
W71-04303

2H. Lakes

GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
Michigan Water Resources Commission, Lansing. Dept. of Natural Resources.

Department of Natural Resources, WDS-4, January 1970. 18 p, 21 fig. Supported by a Water Resources Council Grant.

Descriptors: *Shore protection, *Erosion control, *Great Lakes, *Littoral drift, *Soil erosion, *Flood damage, Bank stability, Michigan, Lake shores, Lake Erie, Lake Michigan, Lake Huron, Seiches, Wind tides, Land management, Sediment control.
Identifiers: *Shoreland management.

A program has been developed and introduced to the Michigan Legislature to provide for the protection, effective management, and maintenance of the quality of the Great Lakes shorelands of Michigan. Included are provisions to: require zoning of shorelands; establish the responsibilities of the Department of Natural Resources and the Water Resources Commission; authorize engineering and special studies of the shorelands; and develop a comprehensive plan for the use of the shorelands. The shorelands of some of Michigan's southern counties are over 80 percent developed. Erosion is a natural process; however, when water levels are high and when high winds occur, damage can be severe. In addition to damages caused by normal weather during high water, there is a threat of short but violent fluctuations from seiches that can inundate large areas within minutes. Primary damage results from erosion of the shoreline, causing physical loss of land areas, trees, structures, docks, homes, cottages and roads. Accelerated sedimentation impairs water quality, increases domestic water treatment costs, destroys aquatic life and habitat, and fills river mouths. A shoreland management program should give first priority to assuring that new developments along the Great Lakes will not be subject to erosion effects. A partnership management program between the Michigan State government and local governments is suggested. (Poertner)
W71-03908

THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W71-03918

EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
John P. Barlow, William Schaffner, and Virginia B. Scarlet.
Available from NTIS as PB-197 123, $3.00 in paper copy, $0.95 in microfiche. Technical Report 21, June, 1970. 16 p, 2 tab, 1 fig, 5 ref. OWRR Project No. A-007-NY (2).

Descriptors: *Nutrients, *Phytoplankton, *Stratification, Phosphates, Silicates, New York, Water pollution effects, Aquatic environment, Lakes.
Identifiers: *Cayuga Lake (N.Y.).

The role of nutrients in regulating phytoplankton populations remains a problem of central importance in aquatic ecology. It is of particular interest during the period of summer stratification. Cayuga Lake was used in this study since it is a favorable environment for investigating nutrient effects on phytoplankton. It is strongly stratified in the summer, and both phosphate and silicate are reduced to low levels, whereas nitrate remains relatively abundant. During 1966, Hamilton performed a series of nutrient enrichment experiments in which he tested effects of major nutrient elements on rates of 14-C uptake in short-term experiments. During the summers of 1967 and 1968 similar enrichment experiments were continued and were described here. Water samples for experiments and for nutrient and phytoplankton analyses were obtained from mid-lake between Portland Point and Taughannock Point for both years. Silicate and phosphate for the two summers were shown and compared to Hamilton's values for 1966. The phytoplankton populations were more difficult to compare. A total of seven experiments were completed in 1967 and the results were summarized. The following summer the experiments were modified and twelve additional experiments were then performed. The results of all nineteen experiments were then summarized. A discussion and comparison of the experiments of 1967 and 1968 followed.
W71-03923

A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX: A FRESHWATER IMPOUNDMENT,
Virginia State Coll., Petersburg. Dept. of Biology.
B. R. Woodson, and T. D. Atkinson.
Virginia Journal of Science, Vol 21, No 4, p 185-195, 1970. 11 p, 11 fig, 2 tab, 12 ref.

Descriptors: *Limnology, *Lakes, *Virginia, Winter, Aquatic environment, Biological properties, Chemical properties, Surface waters, Fresh water, Thermocline, Water chemistry, Hydrologic data, Data collections, Water temperature, Plankton, Zooplankton, Chemical analysis, Benthos, Tripton, Water quality.
Identifiers: *Lake Wilcox (Virginia).

A fourteen week winter limnological investigation was conducted on Lake Wilcox, Virginia from January 22 until April 23, 1969. The purpose of the study was to gain information concerning the winter populations of phytoplankton and zooplankton as well as the chemical and physical characteristics of the water. Plankton populations were generally negligible, with only a few different genera observed. Winter phytoplankton genera consisted mainly of diatoms, and zooplankton genera were primarily rotifers. A high allochthonous tripton load limited the Secchi-disc transparency to 0.8 m or less throughout the study. Iron was found in low quantities (1.0 to 3.5 ppm). Phosphates were generally low (0.06 to 0.25 ppm at surface, 0.06 to 0.23 ppm at 3m, and 0.06 to 0.29 ppm, benthic). Hydrogen-ion concentration and bicarbonate alkalinity showed Lake Wilcox to be neutral to slightly alkaline. Calcium was quite low with a maximum of 9.4 ppm during earlier sampling dates under winter conditions, and decreased to 3.3 ppm under spring conditions. (Woodard-USGS)
W71-03957

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 02B.
W71-04020

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02A.
W71-04139

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 02A.
W71-04140

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA: INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
Heidelberg Univ. (West Germany). Physikalisches Institut (II).
For primary bibliographic entry see Field 02A.
W71-04141

PERCH LAKE EVAPORATION STUDY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 02A.
W71-04142

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.

-04184

Water in Plants

LUENCE OF TEMPERATURE AND OTOPERIOD ON GROWTH, FOOD CON-IPTION AND FOOD CONVERSION EFFI-NCY OF CHANNEL CATFISH,
ansas Univ., Fayetteville. Dept. of Zoology.
primary bibliographic entry see Field 05C.
-03920

OLOGICAL SIGNIFICANCE OF ALIEN NTS IN CALIFORNIA GRASSLANDS,
fornia State Div. of Forestry, Sacramento.
primary bibliographic entry see Field 04A.
-04233

ASUREMENT OF WATER POTENTIAL TH THERMOCOUPLE PSYCHROMETERS: NSTRUCTION AND APPLICATIONS,
est Service (USDA), Logan, Utah. Intermoun-Forest and Range Experiment Station.
W. Brown.
DA Forest Serv Res Pap INT-80, 1970. 27 p.

criptors: *Water measurement, *Moisture ss, *Water loss, *Soil-water-plant relationships, oisture tension, *Soil moisture meters, *Soil er, Plant physiology, Soil moisture retention, physics, Soil water movement, Wilting point, e energy, Equilibrium, Hygrometry, Utah.
ntifiers: *Thermocouple psychrometers, *Soil er potential, *Plant water potential, Soil-plant-osphere continuum, *Plant-water relations, il water relations.

use and construction of the thermocouple chrometer for measurements of soil and plant er potential are discussed. The effects of ceram-nd screen protective cups on the rates of water or exchange between the soil mass and the chrometer cavity are compared. The ceramic imposes a much greater resistance to vapor hange than the screen cups; the magnitudes of sible errors resulting from this resistance in esti-es of water potential are discussed. Possible s of thermocouple psychrometers for measuring er potentials of soils and plants under intensive est management practices are considered. own-Forest Service)
1-04237

TER POTENTIAL MEASUREMENTS IN ESS,
est Service (USDA), Logan, Utah. Intermoun-Forest and Range Experiment Station.
rman H. Wiebe, Ray W. Brown, T. W. Daniel, Eric Campbell.
Science Vol 20, No 4, p 225-226, February 15, 0.

scriptors: *Water measurement, *Moisture ss, *Water loss, *Soil-water-plant relationships, oisture tension, Transpiration, Mositure availa-ty, Water balance, Trees, Soil water movement, il water, Soil moisture meters, Plant physiology, h.
ntifiers: *Thermocouple psychrometers, ater potential, Soil-plant-atmosphere contiuum, ter potential gradients, Plant water stress, ant water relations.

ter potentials of trees growing under natural ditions were measured in situ with thermocou-psychrometers. Miniature models of chrometers used in soil research were inserted oles drilled into the outer xylem of tree trunks branches as small as 2 cm diameters. (The chrometers had been calibrated at different peratures in solutions of known osmotic value, these calibrations were used in calculating the ter potential from the psychrometer readings.) ter potentials decreased with increasing tance from the roots; they were also lower on hot, dry days than on rainy days or at night. Water potentials of twigs, determined with the pressure chamber technique, were always lower than those of the respective branches, while water potentials of leaf sections determined with a laboratory psychrometer were even lower. These studies confirm a continuous gradient of decreasing water potential from soil to trunk, branches, twigs and leaves. The branches studied were within 2 m of the ground, and the gradients were probably caused by resistance within the trees rather than altitudinal differences. The three methods agreed with each other, and can be used for measuring water potentials in situ in the entire soil-plant-leaf system. (Brown-Forest Service)
W71-04238

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS: DESIGN AND APPLICATION,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Ray W. Brown.
Agronomy Journal, Vol 61, p 644-647, July-August 1969.

Descriptors: *Moisture content, *Soil-water-plant relationships, Water balance, *Water loss, *Wilting point, *Bouyoucos blocks, *Moisture availability, *Moisture stress, *Moisture tension, Soil moisture meters, Soil moisture, Wilting, Transpiration, *Water measurement, Utah.
Identifiers: Relative water content, Leaf cutter, Relative turgidity.

A leaf sampler capable of holding eight samples has been designed and used for measuring the relative water content of plant tissues. The precision-made leaf cutter and sample chambers permit the collection of leaf tissue disks from leaves still attached to the plant. After excision, tissue samples can be sealed immediately in small vials within the sample chambers to prevent evaporative water loss. Relative water content values of orchardgrass leaf samples obtained with the leaf sampler were higher, without exception, than were the values of similar samples obtained with a cork borer. However, these differences were not significant until permanent wilting was approached. (Brown-Forest Service)
W71-04239

ASPEN SPROUT PRODUCTION AND WATER USE,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Robert S. Johnston.
USDA, Forest Serv Res Note INT-89, 1969. 6 p, 3 fig, 3 tab.

Descriptors: *Water loss, *Soil water, *Evapotranspiration control, Soil moisture, Soil water, Nuclear moisture meters, Soil moisture meters, Forest management, Watershed management, Vegetation effects, Mountain forest, Utah.
Identifiers: Aspen trees.

Sprouting response and soil moisture depletion on aspen plots were compared under four experimental conditions: (a) clearcut, (b) clearcut, stumps sprayed with sodium arsenite, (c) basal injection of sodium arsenite, and (d) control. Numbers of sprouts varied with treatment for 2 years, but after 4 years the numbers of sprouts on all plots were about equal. Clearcutting the aspen reduced soil moisture depletion by 3 to 4 inches in a 6-foot soil profile during each of three growing seasons. (Johnston-Forest Service)
W71-04241

FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
Cario Univ., Giza (Egypt). Faculty of Science; and Ministry of Agriculture, Cairo (Egypt). Soil Research Dept.
K. H. Batanouny, and M. H. Batanouny.
Acta Botanica Academiae Scientiarum Hungaricae, Vol 15, No 1-2, p 1-18, 1969. 14 fig, 8 ref.

Descriptors: *Root development, *Xerophytes, *Halophytes, *Physiological ecology, *Soil-water-plant relationships, Arid lands, Salt marshes, Soil water, Grasses, Soil physical properties, Water utilization, Monocots, Dicots, On-site investigations, Root systems, Root distribution, Plant growth, Environmental effects, Saline water, Root zones, Deserts, Sands.
Identifiers: *Egypt, *Adventitious roots, *Phytogenic hillocks, Shoots.

A number of arid zone plant species growing in deserts, coastal dunes and salt marshes are able to form phytogenic mounds. During or after the formation of the mounds, root and shoot modifications occur. Particularly outstanding is the development of adventitious roots. In an effort to describe in detail and discover the physiological significance of these structural changes, 7 Egyptian species were investigated: Artrochnemon glaucum, Anabasis articulata, Suaeda pruinosa, Aristida scoparia, Limoniastrum monopetalum, Zygophyllum album and Pennisetum dichotomum. The root systems--both primary and adventitious--were uncovered and drawn, the floristic associations at the site described, soil properties analyzed and areal water conditions noted. It was concluded that soil accumulation stimulated adventitious root formation which may often be greater in surface area than the primary roots. These roots function in accumulating organic matter and binding soil water, probably being responsible for a considerable part of total plant water uptake. The plants are classified according to adventitious root structure: I. Monocotyledenous species--long, thread-like roots; II. Dicotyledenous species, Type A-Laterals similar to primaries; Type B-Hairy, fine, short and only in mound body; Type C-Both long, thread-like and tufted, fine. (Casey-Arizona)
W71-04295

PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
California Univ., Los Angles. Lab. of nuclear Medicine and Radiation Biology.
Janice C. Beatley.
AEC Contract No. AT (04-1) Gen-12. Madrono, Vol 20, No 6, p 326-332, April 1970. 2 tab, 2 ref.

Descriptors: *Arid lands, *Rainfall, *Soil moisture, *Plant populations, Ecology, Environmental effects, Nevada, Grasses, Legumes, On-site data collections, Rain gages, Plant growth, Biological communities, Elevation, Seasonal, Germination, Xerophytes, Deserts, Annual.
Identifiers: *Perennation, *Transects, *Adaptability, *Seedlings, Mojave Desert.

In late winter-early spring of 1965, unusually heavy rains fell at the Nevada test site in south-central Nevada. These were followed by conspicuously large numbers of A. lentiginosus (Leguminosae) and T. pulchellus (Gramineae). In late autumn, 1965, the rains were even heavier and were followed in the spring of 1966 by spectacular flowering populations of A. lentiginosus. On permanent study sites in the area, year-round data collections were kept on environmental variables and plant populations. Most of the Astragalus seedlings lived to flower the following spring, then died. These were distinctly biennials. Perennial populations occurred mostly at higher elevations associated with more frequent and greater rainfall. Seeds of T. pylchellus may germinate in either spring or fall and, for the most part, the plants exhibit a winter annual growth regime. It appears that germination is dependent on soil moisture and perennation is dependent on rainfall regularity. In plants such as Astragalus the ability to occur as annuals, biennials or perennials, may confer a high level of adaptability to a wide range of environmental conditions. (Casey-Arizona)
W71-04299

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
Cairo Univ., Giza (Egypt). Dept. of Botany.
K. H. Batanouny, and M. A. F. Zaki.
Acta Botanica Acadamiae Scientiarum Hungaricae, Vol 15, No 3-4, p 217-226, 1969. 3 fig, 12 ref.

Descriptors: *Soil physical properties, *Root development, *Arid lands, *Plant growth, *Soil-water-plant relationships, On-site investigations, Xerophytes, Environmental effects, Soil chemical properties, Soil structure, Soil texture, Soil moisture, Percolation, Plant populations, Plant morphology, Vegetation establishment, Root systems, Root zone, Ecology, Cultivated lands, Distribution patterns.
Identifiers: *Egypt, Plant associations.

Plant species of widespread distribution show great differences in growth and vitality in differeing areas. Studies of the causes of these differences, particularly in terms of root systems, may yield information on soil and water relations, allowing an adequate assessment of areal crop potential. Root systems and soil properties of 2 common Mediterranean coastal species, Thymelaea hirsuta and Pithyranthus tortuosus, were studied in 5 different plant associations. Soil penetrability was measured with a stratometer. The root systems of both species were shallowest in an association on a degraded, stony, hardly penetrable soil with a low moisture content, and this was accompanied by a relatively small plant size. In an area where this soil was cultivated for barley, the root systems of T. hirsuta were much deeper and the plant much larger. Since it is felt that species genetic potential for growth does not differ between areas, the effect of cultivation must have been a change in soil structure such that resistances to root penetration, percolation and aeration were much lower. This was supported by much lower soil penetrability measurements in the cultivated areas. (Casey-Arizona)
W71-04300

RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
Hawaii Univ., Honolulu. Pacific Biomedical Research Center.
Joel M. Hanna.
American Journal of Physical Anthropology, Vol 32, No 2, p 187-195, March 1970. 3 fig, 5 tab, 14 ref.

Descriptors: *Acclimatization, *Human population, *Arid climates, *Water loss, *Thermal stress, *Physiological ecology, Animal physiology, Temperature, Water balance, Moisture stress, Respiration, Environmental effects, Circulation (Animals), Metabolism, Heat balance, Mode of action, Humidity, Heat resistance, Arizona, Mexico, Deserts, Variability, Data collections, Stress.
Identifiers: *Sweating, *Sonoran Desert, *Anthropology, *Adaptability.

The problem of racial differences in heat tolerance has not been fully investigated in hot, arid climates. Previous evidence infers that acclimatization is a factor at least as important as genetic differences. Groups of Yacqui Indians and Mestizos from Hermosillo, Sonora, Mexico, and Caucasian University students and Papago Indians from Tucson, Arizona, were subjected to exercises in arid summer heat and their physiological responses were measured. The Mestizos and Yaquis showed no significant differences in heart rate, rectal temperatures or sweat rate. However, when White students were compared to Papago Indians, the latter had significantly lower rectal temperatures and sweat rates, which could be accounted for in part by their smaller size. None of the groups demonstrated characteristic changes of acclimatization. In hot, humid environmentally controlled rooms, the Yacquis and Mestizos fell into an intermediate position between acclimatized and unacclimatized Caucasions. It is concluded that desert acclimatization does not confer maximal acclimatization to humid heat. The lower rectal temperatures of the Papagos may represent a more effective, hereditary heat dissipation mechanism. (Casey-Arizona)
W71-04301

EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
Colorado State Univ., Fort Collins. Dept. of Economics; and Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W71-04304

2J. Erosion and Sedimentation

GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
Michigan Water Resources Commission, Lansing. Dept. of Natural Resources.
For primary bibliographic entry see Field 02H.
W71-03908

THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
For primary bibliographic entry see Field 02L.
W71-03943

MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
John D. Gassaway.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1136-1146, December 1970. 11 p, 8 fig, 3 tab, 38 ref.

Descriptors: *Mineralogy, *Bottom sediments, *Currents (Water), *Sediment transport, *Provenance, Florida, Sampling, Dispersion, X-ray analysis, X-ray diffraction, Trace elements, Tracking techniques, Cores, Statistical methods, Distribution patterns.
Identifiers: *Florida Straits, Gulf Stream.

In the Straits of Florida the Florida Current contributes a low-magnesian calcitic biogenic ooze, the Bahama Banks supply highly aragonitic sediments, and 'relict' sediments are the source for the detrital silicates and phosphates. The Miami Terrace Reef has a relatively large amount of high-magnesian calcite. Offshore currents carry the detrital material southward until they are blocked by the Florida Current. Aragonitic sediments move westerly from the Bahama Banks. The mineral suite of the Straits of Florida sediments is composed principally of biogenic carbonates except to the northwest. Strontium and chromium are positively correlated with aragonite. Strontium is not significantly enriched in the carbonate sediments after deposition. Manganese and cobalt vary directly with each other, and statistical analysis shows that they are present in the same phase. The Florida Current is a principal source for the distribution of manganese and cobalt in the Straits of Florida. Iron, zinc and chromium are correlated with the 'relict' sediments to the northwest where their most probable source is the carbonate-fluorapatite. (Knapp-USGS)
W71-03944

A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 02K.
W71-03945

COMPARISON OF THE DESCRIPTORS O SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
Northwestern Univ., Evanston, Ill.
Thomas A. Jones.
Journal of Sedimentary Petrology, Vol 40, No 4, 1204-1215, December 1970. 12 p, 6 fig, 6 tab, 2 ref, append.

Descriptors: *Particle size, *Statistical method Frequency analysis, Charts, Surveys, Gradin Histograms, Sediments.
Identifiers: *Particle size distributions.

Weight-frequency data are routinely analyze either by moment computations or by graphics (percentile) techniques. However, both method have serious drawbacks. The moment measures ar biased, and may have errors induced by groupin or by truncation of part of the sample (pan frac tion). The graphical measures may have error because of interpolation of percentiles. More seri ously the graphical statistics are highly interrelated so varying amounts of skewness and kurtosis wi affect the estimates of all parameters. Because bot the moment and graphical methods have defect an alternative estimation technique is desirable Fitting a cumulative Edgeworth distribution to th observed cumulative data provides estimates whic do not have these undesirable properties. A brie replication study shows that the variance of th Edgeworth estimates is generally less than those o the graphical and sample moment estimates. (K napp-USGS)
W71-03947

DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
Illinois Univ., Urbana. Dept. of Geology.
George DeVries Klein.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1095-1127, December 1970. 33 p, 34 fig, 8 tab, 7 ref.

Descriptors: *Sand bars, *Tidal effects, *Intertidal areas, *Sediment transport, *Sedimentary structures, Currents (Water), Coasts, Shoals, Dispersion, Sedimentary basins (Geological), Tracers, Dye releases, Water circulation, Beaches, Tides, Waves (Water), Mud flats, Sedimentation.
Identifiers: *Minas Basin (Nova Scotia).

The intertidal sand bars of the Minas Basin, Nova Scotia, are asymmetrical in cross-section and linear in plan. They are formed and reworked by tidal currents which are characterized by an asymmetric time-velocity profile. Average bottom ebb current velocities (90 cm/sec) exceed average bottom flood current velocities (65 cm/sec) over gently-sloping (2 to 3 degree) bar surfaces, whereas over steep-sloping (8 degree) bar surfaces, average bottom flood current velocities (90 cm/sec) were found to exceed average bottom ebb current velocities (65 cm/sec). On steeper bar slopes, the sediment is fine-grained sand and is characterized by airholes, planar lamination, and surface dunes and ripples. On the gentler bar slopes, the texture of the sediment is medium-grained and coarse-grained sand which has been fashioned into current ripples, simple dunes, complex dunes, simple sand waves and complex sand waves. Individual tracer grains are dispersed in a radial-elliptical pattern from a point source. The sand bars are aligned parallel to basinal topographic trend and in turn segregate zones of flood- and ebb-dominated bottom current systems. Comparison of low-tide air-photos taken in 1938, 1947, and 1963 in one of the study areas shows a slight erosional regime. (K-napp-USGS)
W71-03948

A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
Geological Survey of India, Calcutta. Marine Geology Unit.
For primary bibliographic entry see Field 07B.
W71-03949

ROBIAL CARBONATE AND PHOSPHATE CIPITATES FROM SEA WATER CUL-ES,
hsonian Institution, Washington, D.C.
primary bibliographic entry see Field 02K.
-03950

IRICAL RELATIONSHIPS BETWEEN S PHYSICAL PROPERTIES FOR RECENT INE SEDIMENTS OFF SOUTHERN IFORNIA,
heed Missiles and Space Co., San Diego, . Ocean Lab.
Inderbitzen.
ne Geology, Vol 9, No 5, p 311-329, mber 1970. 19 p, 7 fig, 5 tab, 29 ref.

riptors: *Bottom sediments, *Physical proper- *Moisture content, *Clay minerals, *Particle Sedimentation, Mechanical properties, Sedi- ation rates, Deposition (Sediments).
tifiers: *Sediment physical properties.

physical property data, obtained by testing cores of recent marine sediments in and nd the continental borderland, were analyzed letermine the relationship between shear gth and sedimentation rate. General increases found in clay and water content with distance ore. Values for void ratio of the sediment in- e with increasing clay-size fraction and ease with increasing shear strength. The slope e void ratio-percent clay relationship appears ed to sedimentation rate: the steeper the slope, aster the rate of deposition. Both the increase ear strength and decrease of water content depth in the sediment appear to be linear func- . There appear to be no direct correlations een sedimentation rate and: (1) amount of size material in the sediment; (2) rate of shear gth increase with depth; or (3) rate of water ent decrease with depth in the sediment. As mentation rate increases, so does the range of r content a sediment may contain for a given entage of clay. The exact limits of that range dependent on the clay mineralogy. As the unt of water within the sediment increases, the r strength decreases. Therefore, the more dly a given material is deposited the more water n contain and the lower its shear strength. (K- -USGS)
-03951

RIATION IN THE LEVEL OF THE FF/SHORE PLATFORM JUNCTION ALONG E SOUTH COAST OF GREAT BRITAIN,
en Mary Coll., London (England).
. Wright.
ine Geology, Vol 9, No 5, p 347-353, ember 1970. 7 p, 3 fig, 16 ref.

criptors: *Shores, *Seashores, *Beach erosion, ches, High water mark, Low water mark, ography, Geomorphology, Marine geology, aces (Geological).
tifiers: *Great Britain.

cise leveling of the junction between the cliff the shore platform has indicated that there is a ation of more than 4 m in its height along the hern coast of Great Britain. At most localities junction is to be found between the Mean High er Spring and Mean High Water Neap levels. al variation may amount to 4 m as a result of interaction of geological, marine and topo- hic variables. Comparable differences occur ween the cliff-line and the stranded shore plat- ns that characterize the coast of south Devon Cornwall. (Knapp-USGS)
1-03952

AL SAND MOVEMENT BETWEEN SOME EAR SAND BANKS IN THE NORTH SEA F NORTHEAST NORFOLK,
ish Petroleum Co., Ltd; Sunbury-on-Thames gland); and National Inst. of Oceanography, rmley (England).
N. D. Caston, and A. H. Stride.
Marine Geology, Vol 9, No 5, p M38-M42, December 1970. 5 p, 2 fig, 10 ref.

Descriptors: *Sediment transport, *Bottom sediments, *Sands, *Ocean currents, Sediments, Bed load, Sedimentary structures, Currents (Water), Sand bars, Shoals.
Identifiers: *North Sea.

In the long sand banks of the southern North Sea off Norfolk, new sand wave and current data indicate a northerly flow of sand on the western sides of the banks and southerly flow on their eastern slopes. The net direction is indicated by the steep northeastern slopes of the banks. Northerly flow is found north and south of them. (Knapp-USGS)
W71-03953

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02K.
W71-03954

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
B. S. Shteyman, A. N. Shatsov, A. N. Tsitsarev, A. A. Yemel'yanov, and V. T. Myshkin.
Translated from Trudy ZakNIGMI, No 32 (38), p 68-78, 1969. Soviet Hydrology: Selected Papers, Issue No 5, p 511-518, 1969. 8 p, 5 fig, 2 tab, 14 ref.

Descriptors: *Deltas, *Sedimentation, *Tracers, *Tracking techniques, Radioactivity techniques, Littoral drift, Sediment yield, Sediment load, Bed load, Suspended load, Provenance, Coasts, Shores, Beach erosion.
Identifiers: *Kura River (USSR).

The movement of sediments on the beach at the mouth of the Kura River, USSR, was studied by various methods, the most promising of which uses the natural radioactivity of the sediments. Natural radioactivity is easily sensed by instruments even at low concentrations, and it is independent of external factors. Sediments contain a large amount of radioisotopes of radium, strontium, rubidium, potassium, and other elements. Radiometric methods were used in the investigation of sedimentation at the mouth of the Kura River because standard methods are laborious, point sampling does not exclude an element of randomness, and, most important, sediment sampling over a large water area is time consuming and requires good weather. The radiometric method permits rapid and continuous investigation of deposition of river sediments in the beach area. The longshore flow of Kura River sediments is from the north and toward the beach area of the main southeastern arm. Solid discharge through the northeastern arm is negligible (0.6 million tons/year). The decrease in the flow of sediments through this arm from 50% (1938) to 5% (1965) of the total discharge of the Kura River has produced severe abrasion of the delta shore. Hydraulic conditions in the channel are responsible for the dying out of the northeastern arm. (Knapp-USGS)
W71-03962

SOME ASPECTS OF THE FORMATION OF MUDFLOWS AND METHODS OF COMPUTING THEM,
Yu. B. Vinogradov.
Translated from Trudy KazNIGMI, No 33, p 5-29, 1969. Soviet Hydrology: Selected Papers, No 5, p 480-500, 1969. 21 p, 8 fig, 1 tab, 16 ref, 3 append.

Descriptors: *Mudflows, *Floods, Classification, Erosion, Sediment transport, Mass wasting, Sedimentation, Sedimentology, Geomorphology, Sediment yield, Open channel flow.
Identifiers: *Mudflow classification.

A classification scheme of mudflow phenomena is presented. The classification is based on the following principle: the input is the character of hydrometeorological processes that lead to given flood conditions; the qualitative transformation operator is the type of mudflow source, which reacts in a definite manner to the hydrometeorological situation; and at the output is the type of mudflow process. Hydrometeorological conditions of mudflow formation include heavy showers of sufficient duration, extremely fast rate of snow melting under exceptional conditions (such as volcanic eruptions, for example), and waves of water released during breaches of temporarily impounded lakes or artificial mountain reservoirs. The types of catchments include catchments with active surface runoff, erosional mudflow sources composed of loose and relatively easily destroyed and eroded material with occasional inclusions of rock fragments, erosional mudflow sources consisting of blocky rock debris with a highly erosible filler, and rocky mudflow sources. Types of mudflow phenomena are mud floods, gravity flows of soil suspension, and gravity rock flows. (Knapp-USGS)
W71-03963

HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
N. S. Znamenskaya.
Translated from Trudy Gos Gidrol Inst-ta, No 173, p 43-48, 1969. Soviet Hydrology: Selected Papers, No 5, p 452-455, 1969. 4 p, 1 fig, 5 ref.

Descriptors: *Scour, *Sediment transport, *Bed load, Alluvial channels, Open channel flow, Hydraulics, Channel morphology, Froude number, Reynolds number, Viscosity, Tractive forces, Roughness (Hydraulic).
Identifiers: *Mobile-bed streams.

The main forces determining turbulent flow are gravity, inertia, and viscosity. The most common criteria used in the hydraulics of open channels are dimensionless relationships including Froude number, which allows for the forces of intertia and gravity, and Reynolds number, which takes into account the forces of inertia and viscosity. Hydraulic criteria must be used with criteria reflecting the mobility of the sediments. Mobility depends on size and specific weight. Dimensionless ratios used as criteria of bed load mobility include the ratio of average velocity to nonscouring velocity, and the ratio of the drag force to the critical drag force. The fact that the start of particle movement is related to observable velocity and drag data is in favor of these or similar criteria. The best criterion in use at present is the ratio of average velocity to fall velocity because: (1) the fall velocity may be determined much more accurately than the nonscouring velocity; (2) the variation in fall velocity with temperature is known; and (3) results have been obtained from study of the variation of fall velocity with the concentration of suspended particles. (Knapp-USGS)
W71-03965

ROD-MOUNTED BOTTOM GRAB,
For primary bibliographic entry see Field 07B.
W71-03967

PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
E. A. Konditerova, and I. V. Ivanov.
Translated from Trudy Gos Gidrol Inst-ta, No 169, p 3-17, 1969. Soviet Hydrology: Selected Papers, No 4, p 356-364, 1969. 9 p, 5 fig, 1 tab.

Descriptors: *Meanders, *Alluvial channels, Geomorphology, Channel morphology, Rivers, Stream erosion, Scour, Sediment transport, Sedimentation.
Identifiers: *Irtysh River, *USSR, Stream length.

In studying the morphometric patterns of various types of channel processes the Department of Channel Processes of the State Hydrologic Institute, USSR, examined the patterns of free mean-

dering. This type of channel process occurs over about half (42%) of the length of the Irtysh River reaches studied. The purpose of this study was to determine the main patterns of change in river length under free meandering conditions. On the whole, the entire reach of the Irtysh River under study has shortened by only 650 m between 1904 and 1958. This reach (380 km long), confined to a morphologically uniform, free meandering stretch without tributaries, is an example of a closed cycle of length changes of a type of channel process where free meandering clearly predominates. With predominantly free meandering, the increase in the length of meanders during their horizontal deformations was compensated by breaches in channel loops. The rapid elongation of individual meanders may stabilize the development of neighboring meanders by reducing the rates of their horizontal deformations. (Knapp-USGS)
W71-03969

MUD FLOWS AND FLOODS AND THEIR CONTROL,
M. S. Gagoshidze.
Trans from Gidrotekhnika i melioratsiya, No 11, p 29-43, 1969. Soviet Hydrology: Selected Papers, No 4, p 410-422, 1969. 13 p, 10 fig, 2 tab, 11 ref.

Descriptors: *Mudflows, *Flood control, Dams, Floods, Check structures, Regulation, Sediment transport, Flood protection, Flash floods, Diversion, Flow control.
Identifiers: *Mudflow control, USSR.

Mudflows are dense, cohesive, and structured. The water in the mud mass is bound and does not perform a transporting function. Mud floods are fluid, turbulent, and noncohesive. The water in them is enriched with a colloidal suspension and is the transporting medium. Mudflows are the most destructive type of mountain runoff. They form in nearly all the mountain regions of the Soviet Union. Protection from mudflows and improvement of a mudflow basin is achieved by a combination of organizational-agricultural, phytoreclamation, and hydraulic engineering measures. Hydraulic installations are used to control mudflows that have already formed. (1) Mudflow regulating structures are designed to conduct, direct, discharge, and break the mudflows. (2) The mudflow separating structures (contracted weirs, openwork dams, cable mud cutters, and sediment barriers) are designed to arrest the coarse and pass the small fraction of the mudflow. (3) Solid structures (dams, excavations, dikes) are built to arrest mudflows and other types of mountain flow. Arresting structures with openings (openwork dams) are built to arrest the mudflow mass and pass the flood runoff. (4) Mudflow transforming sturctures are designed to transform structural mudflows into floods. (Knapp-USGS)
W71-03970

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
California Univ., Berkeley. Dept. of Civil Engineering.
Hans A. Einstein.
California University Water Resources Center Technical Completion Report, January 22, 1969. 6 p. OWRR Project A-023-CAL (1).

Descriptors: *Sediment transport, *Degradation (Stream), *Reviews, *Stream erosion, *Dams, Streams, Flow control, Equilibrium, Streamflow, Investigations, Model studies, Flumes, Channel morphology, Streambeds, Stress, Flow resistance, Boundaries (Surfaces), Flow rates, Sediments, Cross-sections, Bed load, Statistical analysis, Friction, Scour, Particle size.
Identifiers: Dam effects on downstream channels.

When a dam is constructed across a river the equilibrium of sediment movement is greatly disturbed causing the river downstream to start degrading, a process that continues until a new equilibrium is reached. This report summarizes studies made on the subject since 1963. Some of the results are as follows: (1) The friction factor for a flow over a sediment bed is usually divided into two parts, the grain resistance and the shape resistance. Both are present in a degrading bed of uniform material the same as in an equilibrium flow. In mixed beds, segregation must be taken into account. (2) A flume study conducted in a circular flume of rectangular cross section showed that the shape of the sediment bed may be predicted from the velocity distribution. (3) A generalized shape of river cross-sections can be predicted as a function of the river curvature of the channel preceding the section. (4) Check experiments verified that during scour the roughness of a mud bottom is somewhat higher than at equilibrium. At equilibrium the mud, consisting of silt and clay in salt water, is hydraulically smooth. (5) Scattered blocks on a slowly scouring sediment bed of small sediment transport will by their additional resistance first reduce the shape resistance of the bed, and only after that will they reduce the sediment transport and scour. (Woodard-USGS)
W71-03995

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03999

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04048

SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 02G.
W71-04050

SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Geography.
For primary bibliographic entry see Field 02G.
W71-04053

ON THE ACCURACY OF BED-MATERIAL SAMPLING,
Waterloopkundig Laboratorium, Delft (Netherlands).
M. de Vries.
Text also in French. Journal of Hydraulic Research, Vol 8, No 4, p 523-533, 1970. 11 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Sampling, *Bottom sediments, *Statistical methods, *Statistics, *Sieve analysis, Analytical techniques, Sands, Gravels, Particle size, Sieves, Measurement, Data collections, Probability, Variability.
Identifiers: *Bed sediment sampling.

The minimum amount of sediment to be sampled for a valid statistical analysis was determined analytically and compared with results of field studies. The results of the analysis are especially valuable if relatively coarse sediments are studied. For fine sand the samples are usually large enough to assume the presence of small errors. Coarse sand and gravel require samples too large to be sieved directly. Sample splitting and sieving of all parts is required. The composition of the bed material may change with time and place. If there exists a large degree of inhomogeneity, the selection of the loc tions of sampling becomes important. In this ca the required accuracy for each sample may b rather low, unless the degree of inhomogeneity the topic to be studied (grain-sorting). (Knap USGS)
W71-04132

AN OVERVIEW OF U.S. DEPARTMENT OF I TERIOR'S ROLE IN SEDIMENT CONTROL,
Federal Water Quality Administration, Washin ton, D.C. Div. of Applied Science and Technolog and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04147

TECHNOLOGY FOR SEDIMENT CONTROL I URBAN AREAS,
Agricultural Research Service, Washington, D.C Sedimentation Lab.
For primary bibliographic entry see Field 04D.
W71-04148

THE CONTROL OF EROSION AND SEDIMEN IN HIGHWAY CONSTRUCTION,
Bureau of Public Roads, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04149

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY: THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 04D.
W71-04230

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
R. O. Meeuwig.
Journal of Range Management, Vol 23, No 3, p 185-188, May 1970. 4 p, 8 fig.

Descriptors: *Infiltration, *Erosion, *Vegetation effects, *Soil properties, Soil aggregates, Soil density, Organic matter, Soil surfaces, Utah, Soil moisture, Simulated rainfall.
Identifiers: *Slope gradient.

The influences of vegetation, soil properties, and slope gradient on infiltration capacity and soil stability of high-elevation herbland on the Wasatch Front in northern Utah were investigated under simulated rainfall conditions. Results emphasize the importance of vegetation and litter cover in maintaining infiltration capacity and soil stability. Infiltration is also affected significantly by soil properties, notably bulk density, aggregation and moisture content. (Meeuwig-Forest Service)
W71-04260

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
R. O. Meeuwig.
USDA Forest Service Research Note INT-103, 1969. 5 p, 2 fig.

Descriptors: *Infiltration, *Erosion, *Vegetation effects, Soil texture, Organic matter, Wettability, Idaho, Simulated rainfall.
Identifiers: *Non-wettable soils.

The infiltration and erosion caused by simulated rainfall were measured on a granitic subalpine ridge in north-central Idaho. Erosion was closely correlated with the amount of exposed soil. Infiltration was not highly correlated with any single factor. However, three soil properties (organic-matter

ent, clay content, and moisture-holding city at 20-centimeter tension) in combination found to be good predictors of infiltration. euwig-Forest Service)
-04261

. Chemical Processes

ECT OF DISPERSION, GRAVITATIONAL REGATION, AND FORMATION STRATIFI-TION ON THE RECOVERY OF FRESH-TER STORED IN SALINE AQUIFERS,
isiana State Univ., Baton Rouge.
primary bibliographic entry see Field 02F.
-03870

E INCIDENCE AND FORMATION OF MINE AINAGE POLLUTION - APPENDIX C TO PORT FOR DEVELOPMENT OF WATER SOURCES OF APPALACHIA'.
ps of Engineers, Cincinnati, Ohio. Office of Ap-chian Studies.
primary bibliographic entry see Field 05B.
-03872

REAM POLLUTION BY COAL MINE AINAGE IN APPALACHIA.
eral Water Quality Administration, Cincinnati, o.
primary bibliographic entry see Field 05B.
-03873

REVIEW OF CURRENT RESEARCH ON AL MINE DRAINAGE IN APPALACHIA,
reau of Mines, Pittsburgh, Pa. Area 1 Mineral sources Office.
primary bibliographic entry see Field 05B.
-03874

CTORS THAT AFFECT THE FORMATION COAL MINE DRAINAGE POLLUTION IN PALACHIA,
reau of Mines, Pittsburgh, Pa. Area 1 Mineral source Office.
r primary bibliographic entry see Field 05B.
-03875

E OXIDATION OF PYRITE ASSOCIATED TH COAL MINES,
reau of Mines, Pittsburgh, Pa. Area 1 Mineral source Office.
r primary bibliographic entry see Field 05B.
-03876

NTISTRY PROFESSOR EXPLAINS POLY-ATER.
r primary bibliographic entry see Field 01B.
-03926

ECTROPHOTOMETRIC DETERMINATION THIOCYANATE AND OXALATE,
ssouri Univ., Columbia. Dept. of Chemistry.
r primary bibliographic entry see Field 05A.
-03928

UALITY OF RUNOFF FROM DIVERSIFIED RBAN WATERSHEDS,
izona Univ., Tucson. Dept. of Civil Engineering d Engineering Mechanics.
r primary bibliographic entry see Field 05A.
-03929

ATER-QUALITY DATA FOR THE FLAMING ORGE RESERVOIR AREA, UTAH AND YOMING,
eological Survey, Salt Lake City, Utah.
r primary bibliographic entry see Field 07C.
-03936

ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W71-03939

PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03940

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 02G.
W71-03941

THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
Kentucky Univ., Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03942

A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
Kentucky Univ., Lexington.
Bruce R. Moore, and William H. Dennen.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1147-1152, December 1970. 6 p, 2 fig, 1 tab, 38 ref.

Descriptors: *Sediments, *Weathering, *Diagenesis, *Metamorphic rocks, *Provenance, Geochemistry, Igneous rocks, Classification, Aluminum, Iron, Sediment transport.
Identifiers: *Sorting (Sediments), Silicon.

Plots of the principal elements Si, Al, Fe for normal clastic sediments reveal a very definite geochemical trend for these elements. Al/Fe ratios lie between 1.5 and 2.5 while Si is continuously variable but has clearly distinguishable ranges for each of the currently used sediment types when plotted on a Si-Al-Fe ternary diagram. Igneous rocks undergoing weathering tend to move in composition toward the Si, Al, Fe 'main sequence' and later separate by hydraulic sorting toward either the coarser quartzose sandstone or finer shale ends of this sequence. The results indicate the possibility of clarification of existing classifications and of determining the parent-rock types of certain metasediments. (Knapp-USGS)
W71-03945

MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
Smithsonian Institution, Washington, D.C.
P. G. Malone, and K. M. Towe.
Marine Geology, Vol 9, No 5, p 301-309, December 1970. 9 p, 3 fig, 27 ref.

Descriptors: *Water chemistry, *Carbonates, *Phosphates, *Sea water, *Biodegradation, Nitrates, Organic matter, Chemical precipitation, Nutrients, Calcium carbonate, Calcite, Diagenesis, Connate water.
Identifiers: Struvite.

Nitrogenous organic materials were allowed to decompose in seawater at approximately 24 deg C under varying conditions of aeration. In aerated cultures the mineral struvite (NH4-MgPO4.6H2O) is formed by a reaction between phosphate and ammonia from the decomposing organic material and magnesium in the seawater. Cultures grown in paper-plugged flasks produced precipitates consisting of struvite and monohydrocalcite. Cultures grown in tightly-stoppered flasks produced a precipitate consisting of calcite containing approximately 14 mol% MgCO3 and struvite. The uncomplicated nature of these results suggests that similar phases may be produced in varying natural situations where nitrogenous organic material decays in seawater or in contact with interstitial water in sediments. (Knapp-USGS)
W71-03950

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
Woods Hole Oceanographic Institution, Mass.
F. T. Manheim.
Earth and Planetary Science Letters, Vol 9, No 4, p 307-309, November 1970. 3 p, 1 fig, 1 tab, 20 ref.

Descriptors: *Diffusion, *Ion transport, *Sediments, *Porosity, Diffusivity, Aqueous solutions, Electrolytes, Translocation, Ion exchange, Diagenesis, Viscosity, Water temperature, Clays, Clay minerals, Connate water.
Identifiers: *Ion diffusion.

Diffusion in unconsolidated sediments generally proceeds at rates ranging from half to one twentieth of those applying to diffusion of ions and molecules in free solution. Diffusion rates are predictable with respect to porosity and path tortuosity in host sediments, and can be conveniently measured by determinations of electrical resistivity on bulk sediment samples. Net ion flux is further influenced by reactions of diffusing species with enclosing sediments, but such influences should not be confused with or lumped with diffusion processes. (Knapp-USGS)
W71-03954

SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
Kurt Bostrom.
Earth and Planetary Science Letters, Vol 9, No 4, p 348-354, November 1, 1970. 7 p, 6 fig, 12 ref.

Descriptors: *Water chemistry, *Iron, *Sea water, *Distribution patterns, *Geochemistry, Solubility, Chemical precipitation, Volcanoes, Aqueous solutions, Sediments, Deposition (Sediments).
Identifiers: Iron distribution (Pacific).

Deposition rates of iron on the East Pacific Rise are 4-30 times larger than in surrounding areas of the Pacific, suggesting local volcanism to be the source of iron. The distribution of Co, Ni, Mn, Ti and Al support this conclusion. Other geochemical relations in the East Pacific also suggest that the iron sediments on the Ridge are of local origin. Stability relations for oxides-hydroxides of Fe, Mn, Ni and Co suggest that in the well-oxygenated slightly alkaline bottom waters of the ocean, iron should precipitate out fairly fast, followed by manganese, whereas Ni and Co should be most mobile and tend to be enriched in the moist land-distant areas. Because continental matter has been recycled repeatedly during the history of the Earth while the volcanic iron described may represent a new contribution to the surface of the Earth, and because ocean floor spreading may have been operating during most of the history of the Earth, it follows that a large fraction of the total amount of iron now at the Earth's surface may have been brought up by submarine volcanism. (Knapp-USGS)
W71-03955

CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
Naval Oceanographic Office, Washington, D.C. Project GOFAR.
Roger Hart.
Earth and Planetary Science Letters, Vol 9, No 3, p 269-279, October 1970. 11 p, 4 fig, 2 tab, 40 ref.

Descriptors: *Basalts, *Hydration, *Ion exchange, *Mineralogy, *Water chemistry, Distribution patterns, Leaching, Solubility, Elements (Chemical), Sea water, Weathering, Chemical reactions.
Identifiers: *Oceanic basalts.

Analysis of 112 deep ocean basalts reported in the literature show systematic chemical trends in major elements with distance from ridge spreading centers. These same trends are observed in the weathering of single pillows and produce a chemical composition similar to volcanic alkali basalts. Upon hydration by sea water, tholeiitic ridge basalts give off silica, calcium, magnesium, and gain potassium, iron, titanium, manganese, sodium and phosphorus. Aluminum shows no apparent change. The yearly contribution to sea water in nanograms of the major elements per cc of basalt is estimated at Si—..7.4, Ti—-1.6, Fe—-3.3, Mn—0.06, Mg—..2.3, Na—-0.21, Ca—..2.1, K—-0.9, and P—-0.14. (Knapp-USGS)
W71-03956

SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
N. G. Dyukel.
Translated from Trudy UkrNIGMI, No 85, 1969, p 104-111. Soviet Hydrology: Selected Papers, No 4, p 381-387, 1969. 7 p, 4 fig, 4 tab, 5 ref.

Descriptors: *Water temperature, *Climates, *Altitude, *Surface-groundwater relationships, *Thermal pollution, Surveys, Data collections, Hydrologic data.
Identifiers: *USSR, *River thermal regime.

The thermal regime of rivers in the Tissa, Seret, Prut, and Dniester basins, USSR, is determined by climatic conditions and, primarily, by air temperature. The strongest disturbances are observed in reaches where groundwater discharges. The thermal regime is also strongly affected by human activity, such as the discharge of warm industrial waters into rivers, river regulation by ponds and reservoirs, etc. To characterize the thermal regime of rivers, an analysis was made of natural and artificially disturbed regimes in a thermal survey. The natural thermal regime was analyzed separately for river reaches with strong and with moderate groundwater recharge. The relationship between air and water temperatures was found to be single-valued on river reaches with moderate groundwater recharge. The thermal regime in such reaches varies with latitude in lowland rivers and with elevation in the mountain rivers. The air temperature lapse rate is 0.7 deg C, while the vertical water temperature gradients of rivers in the Dniester basin is 1.6 deg C and in the Danube basin 1.3 deg C. In the cold months (January-March, November, December), the vertical water temperature gradient practically drops to zero. The greatest scatter of points is observed for the warm months (May-September) when the thermal regime is affected even by insignificant local factors, when the difference between the ground and river-water temperatures is the greatest. (Knapp-USGS)
W71-03974

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
Missouri Univ., Columbia. Dept. of Chemistry.
Norman L. Trautwein, and John C. Guyon.
Analytica Chimica Acta (Amsterdam), Vol 41, p 275-282, 1968. 8 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Chemical analysis, *Spectrophotometry, *Chlorides, *Methodology, *Test procedures, Analytical techniques, Research and development, Chemistry, Evaluation, Instrumentation, Ions, Chemical reactions, Absorption, Laboratory tests, Ionization.
Identifiers: *Chemical analysis (Chlorate ion).

A simple, direct, sensitive spectrophotometric method for the determination of chlorate ion is described. The method is based upon the interference of chlorate ion on the formation of a rhenium-alpha-furildioxime complex, whose absorbance maximum is at 532 millimicrons. The effect of several variables is described. The range for the method is 0-5.0 parts per million of chlorate ion. A variety of ions were added to the system in order to study interferences. The principal interferences are copper, thiocyanate, tungstate and uranyl ions. Copper and uranium increase the absorbance and diminish the interference of the chlorate ion. Thiocyanate ion produces a yellow color with perrhenate in the presence of tin chloride. Tungstate forms a precipitate on the addition of tin chloride. (Woodard-USGS)
W71-03994

SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-04001

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $3.50. Geological Survey Water-Supply Paper 1964, 1970. 819 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Surface waters, *Mississippi River Basin, *Data collections, *Hydrologic data, Chemical analysis, Water temperature, Sediment transport, Suspended load, Sediment discharge, Particle size, Sediment load, Streamflow, Water properties, Water chemistry, Sampling, Laboratory tests, On-site investigations, Runoff, Flow rates.
Identifiers: *Lower Mississippi River Basin, *Western Gulf of Mexico Basins.

During the water year ending September 30, 1965, the U. S. Geological Survey maintained 127 stations on 61 streams for the study of chemical and physical characteristics of surface water in the lower Mississippi River Basin and Western Gulf of Mexico Basins. Samples were collected daily and monthly at 125 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 2 and daily at 83 stations. Quantities of suspended sediment are reported for 34 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 22 of the stations. Descriptive statements for the basic-data tables are given for each regular sampling station. These statements include location of the station, drainage area, periods of records available, extremes of dissolved solids, hardness, specific conductance, temperature, sediment loads, and other pertinent data. Records of discharge of the streams at or near the sampling station are included in most tables of analyses. (Woodard-USGS)
W71-04048

STRUCTURE OF WATER IN MICROEMULSIONS: ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
Florida Univ., Gainesville. Dept. of Chemical Engineering; and Florida Univ., Gainesville. Dept. of Anesthesiology.
For primary bibliographic entry see Field 01B.
W71-04108

ARSENIC IN POTABLE DESERT GROUNDWATER: AN ANALYSIS PROBLEM,
Naval Weapons Center, China Lake, Calif. Michelson Labs.; and Boron Community Services District, Calif.
G. C. Whitnack, and H. H. Martens.
Science, Vol 171, No 3969, p 383-385, January 29, 1971. 3 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Arsenic compounds, *Analytical techniques, *Trace elements, *Water pollution, *Groundwater basins, *California, Hydrogeology, Deserts, Potable water, Mineral water, Water analysis, Methodology, X-ray fluorescence, Adsorption, Water chemistry.
Identifiers: *Analysis problem, Arsine evolution, Mohave Desert.

As the result of conflicting reports made in 1969 on the arsenic content of drinking water from ground water sources in the Mohave Desert, a comprehensive study was made of the analytical methods in use. Results of this study and of the consequent investigation of metal interference in the arsine (AsH_3) evolution step are described. Gallon samples of water collected from each of 24 sites were analyzed within 30 days of collection, using techniques of x-ray fluorescence and single-sweep polarography. Data reported by the SDDC method were confirmed for certain of the well waters. Groundwaters of the Boron and China Lake basins are associated with many water-soluble minerals and are more brackish or briny than the usual surface waters for which the colorimetric SDDC method was developed. It is concluded that interference with the evolution of arsine in the American Public Health Association silver diethyldithiocarbamate method used in the 1969 analyses caused either color enhancement or arsine suppression, and this method is unreliable for certain natural water types. (Lang-USGS)
W71-04109

A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
Mellon Inst., Pittsburgh, Pa.; and Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 05A.
W71-04119

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
Denver Board of Water Commissioners, Colo.
For primary bibliographic entry see Field 05A.
W71-04120

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
Missouri Univ., Rolla. Dept. of Geology.
For primary bibliographic entry see Field 05A.
W71-04182

THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
For primary bibliographic entry see Field 01B.
W71-04183

MINERAL RECOVERY FROM CONCENTRATED BRINES,
Brigham Young Univ., Provo, Utah.
Joseph M. Glassett.
Fore sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.75. Office of Saline Water Research and Development Progress Report No 593, December 1970. 79 p, 17 fig, 8 tab, 13 ref, 2 append. OSW Grant 14-01-0001-1302.

Descriptors: *Brines, *Brine disposal, *By-products, *Phase diagrams, *Ultimate disposal, Sodium chloride, Potassium compounds, Magnesium compounds, Sodium sulfate salts, Solubility, Aqueous solutions.
Identifiers: Mineral recovery, Phase rule processes.

al mineral recovery processes are proposed udy to profitably recover valuable minerals the concentrated brine effluent of saline conversion plants. Phase rule processes ap- particularly attractive since no raw materials eeded except the brine itself. The principal ss studied involves: (1) solar evaporation to specific gravity to remove sodium chloride the brine, (2) dilution with 15 volume per fresh water, (3) cooling to -15C to recover mirabilite crystals, (4) a second evaporation 9 specific gravity to remove additional sodi- hloride, (5) dilution with 5 volume per cent water, (6) a second cooling to recover pure e, and (7) a third evaporation to recover car- e and a strong MgCl2 brine. The yield of e was found to be low so as alternative process ggested. This alternative process involves ing the second dilution and cooling steps. The d evaporation in three stages can produce , sylvinite, and carnallite. Sylvite may be ered from sylvinite and from carnallite by nt commercial methods. The residue brine ontain principally magnesium chloride. When ater brine was evaporated to a magnesium ntration of four weight per cent or more, epsomite was obtained during the first cooling instead of mirabilite. (Scott-Office of Saline r)
-04223

Estuaries

ER QUALITY - BENTHIC INVER- RATE RELATIONSHIPS IN ESTUARIES,
e Univ, Walpole, Ira C. Darling Center for arch, Teaching and Service.
rimary bibliographic entry see Field 05C.
-03922

PERIODIC CYCLE OF PARTICULATE TTER IN A SHALLOW, TEMPERATE UARY,
Hampshire Univ., Durham. Jackson Estuarine

z E. Anderson.
nal of Sedimentary Petrology, Vol 40, No 4, p -1135, December 1970. 8 p, 10 fig, 11 ref.

riptors: *Sediment transport, *Suspended *Organic matter, *Estuaries, *Water circula- Tidal effects, Streamflow, Regime, Salinity, r temperature, Ice, Freezing, Mud flats, Inter- areas, New Hampshire, Winds, Waves ter).
tifiers: Bellamy River Estuary (NH).

concentration of particulate matter in the Bel- River estuary, New Hampshire has been ob- d to be strongly periodic over tidal cycles in spring and early summer months and weakly odic or aperiodic during the rest of the year. variation in periodicity appears to be a func- of changing estuarine circulation patterns with discharge, and the protection of the tidal flat e and slush during the winter months. (Knapp- S)
-03943

ERAL AND CHEMICAL COMPOSITION SEDIMENTS FROM THE STRAITS OF RIDA,
ntic Oceanographic and Meteorological Labs., mi, Fla.
primary bibliographic entry see Field 02J.
-03944

POSITIONAL AND DISPERSAL DYNAMICS INTERTIDAL SAND BARS,
ois Univ., Urbana. Dept. of Geology.
primary bibliographic entry see Field 02J.
-03948

SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
John C. Ludwick.
Virginia Journal of Science, Vol 21, No 4, p 178-184, 1970. 7 p, 6 fig, 20 ref. ONR Contract No N00014-70C-0083.

Descriptors: *Sedimentary structures, *Sand waves, *Tidal waters, *Bays, *Channel flow, Channel morphology, Alluvial channels, Currents (Water), Flow characteristics, Sands, Sand bars, Profiles, Waves (Water), Shoals, Sediment transport, Velocity, Shear stress.
Identifiers: *Chesapeake Bay entrance, *Tidal channels.

Sand waves 5-12 feet in height and 200-1200 feet in length occur in water 25-50 feet deep in the sand bank and tidal channel area of the entrance to Chesapeake Bay. Most waves are asymmetrical in transverse profile, some facing with ebb currents, others facing with flood currents, depending on which is dominant at a given place. Steep slopes on the various waves range from 4 to 21 deg and average 12 deg. The sand waves occur in association with tidal channels and especially on the flanks of shoals that form channel boundaries. Migration of sand waves, judged from their facing direction, is a bed sediment transport mechanism by which sand is moved up onto shoals. Many large shoals of the area occur between ebb-dominated and flood-dominated channels. This implies the existence of net circulation loops of water and sediment in cells located over shoals. The action of such cells is to trap sediment. Other ebb-flood shear zones may mark sites of future shoaling in the entrance. (Woodard-USGS)
W71-03958

ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
Michigan Univ., Ann Arbor. Inst. of Science and Technology.
For primary bibliographic entry see Field 07B.
W71-03959

SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
Naval Research Lab., Washington, D.C.
J. D. Bultman, W. D. Garrett, N. L. Jarvis, and J. B. Romans.
Available from NTIS as AD-713 142, $3.00 in paper copy, $0.95 in microfiche. Memorandum Rept. No NRL-MR-1435, June 1963. 15 p, 10 fig, 1 tab, 2 ref.
Identifiers: *Sea water, *Surface-active substances, *Monomolecular films, *Oceans, Interfaces, Chemical analysis, *Surface chemistry, *Panama Bay.

A field trip was made to the Bay of Panama during the week of April 8 through April 12, 1963. The purpose of the trip was to carry out experiments dealing ultimately with the surface chemistry of the sea. Surface and subsurface water samples were collected to determine the nature of the adsorbed films that occur on the sea and to learn more of their origin. Experiments were also carried out to determine the rate of adsorption of surface active material at the sea/air interface, and to determine force-area curves for the stable film forming constituent. Efforts were also made to measure in a given small area the percent coverage of the sea by surface active material. In addition, measurements were made of the film pressure of slick covered areas, and an attempt was made to correlate these measurements with the changes in surface potential. Each experiment is discussed briefly in this report with appropriate conclusions and recommendations.
W71-04001

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04009

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04010

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04011

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04012

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04013

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04014

COST OF PATUXENT RIVER QUALITY MONITORING,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 05A.
W71-04115

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
DeBell and Richardson, Inc., Hazardville, Conn.
Bernard Baum, Roy A. White, W. H. Holley, W. R. Diehl, and R. C. Trudeau.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 604, December 1970. 98 p, 17 tab, 20 fig, 7 ref. OSW Contract 14-01-0001-2211.

Descriptors: *Reverse osmosis, *Separation techniques, Pressure, Desalination processes, Membrane processes, *Osmosis.
Identifiers: Membrane supports, *Support tubes, Microporous supports.

Rigid micrporous thermoplastic materials have been developed on a laboratory scale, the best of which, a PVC (polyvinyl chloride) homopolymer, has been successfully extruded into tubulets. These polyvinyl chloride tubulets were leached in water to give porous tubulets which had the desired pore size and reasonable flux. Porous materials in flat sheet form were formulated with a number of polymers and screened for porosity, flux and pore size. The porosity in these materials was produced by compounding water-soluble liquids, salts, resins, or gums into the various rigid thermoplastics, molding them into flat sheets, and extracting the water-soluble materials to produce porous, water-permeable sheets. Water flux was determined by passing distilled water through the sheets at 20-40 psig pressure in a Gelman stainless steel pressure filter funnel, and collecting the effluent in a graduated cylinder. Pore size was established in a preliminary manner by determing if either 1 micron (10,000A) or 0.2 micron (2,000A) latex particles would pass through the sheet or tubulet. Several lots of 0.060' and 0.030' outside diameter polyvinyl chloride tubulets containing polyvinyl methyl ether and a surfactant as the water-leachable components were extruded. One series was extruded from milled compound and the other, to reduce thermal degradation, was extruded from dry blend. (Kindley-Office of Saline Water)
W71-03911

WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
Weizmann Inst. of Science, Rehovoth (Israel).
D. Vofsi, and O. Kedem.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $0.65. Office of Saline Water Research and Development Progress Report No. 591, December 1970. 60 p, 15 tab, 9 fig. OSW Contract 14-01-0001-961.

Descriptors: Desalination, Ion exchange, Ion transport, Membranes, *Membrane processes, Permselective membranes, *Reverse osmosis, *Semipermeable membranes, Separation techniques, *Osmosis.
Identifiers: Hyperfiltration, Pressure dialyais.

'Liquid' and 'plasticized' solvent membranes are of interest as possible analogues of biological systems. Semipermeable homogeneous films are prepared by plasticizing polyvinylchloride with organic phosphates. Water permeability of such films is relatively high. Conditioning of a 'plasticized' membrane, under the osmotic gradient of solution of sodium nitrate leads to profound although usually reversible changes in its morphology and to a drastic increase of its water permeability. Their reversibility in various solutions may be correlated with the respective differences in permselectivity. Porous charged membranes were prepared previously by crosslinking polypeptides in a collodion matrix. Using the same technique polylysine and polyvinylamine can be used as polyelectrolytes, whereas Procion Brilliant Orange MG acts as crosslinking agent. This material can either crosslink polyamines or bind them to a cellulosic matrix. Membranes prepared by this method permit high rate fluxes, but the salt rejection is quite low. However, good separation between hydrochloric acid and copper chloride are obtained in the same membranes; while the acid concentrates in the product, most of the salt remains in the feed. (Kindley-Office of Saline Water)
W71-03912

EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
Fluor Corp. Ltd., Los Angeles, Calif.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $4.25. Office of Saline Water Research and Development Progress Report 580, August 1970. 226 p. OSW Contract 14-01-0001-1830.

Descriptors: *Cost comparisons, *Design criteria, *Desalination processes, *Flash distillation, *Long-tube vertical distillation, Water costs, Capital costs, Desalination, Desalination plants, Distillation, Evaporators, Desalination apparatus, Heat balance, Thermodynamic behavior, Saline water.
Identifiers: *Enhanced surface tubes, Corrugated tubes.

The objectives of this study were to determine, compare and evaluate the relative thermodynamic and engineering characteristics and economics of the Vertical Tube Evaporator (VTE) and the Multistage Flash (MSF) desalination processes. Also, included was a determination and assessment of the relative reliability, maintainability, and potentials of the two types of plants. Capital costs and operating costs were determined and are reported in detail. The main conclusions of the study were: (1) for large size plants (250 mgd) a VTE plant appears to have a distinct economic advantage over the corresponding MSF design; (2) the use of enhanced surface (corrupted) tubes in a large MSF plant would reduce its cost, although the cost of the VTE plant would still be substantially lower; and (3) for plants of 2.5 MGD size, capital costs and production costs for the two types of plants evaluated (VTE and MSF) are very nearly the same, however, the use of enhanced surface tubes in the MSF plant could make that process more economical. (Van Doren-Office of Saline Water)
W71-03913

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 05D.
W71-03914

BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
Southern California Metropolitan Water District, San Diego.
Henry J. Mills.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $2.50. Office of Saline Water, Research and Development Progress Report No. 570, August 1970. 119 p, 26 tab, 2 fig, 19 plates, 3 ref. OSW Contract 14-01-0001-1290.

Descriptors: *Desalination plants, *Flash distillation, *Nuclear powerplants, Dual-purpose, Desalination, *Costs.
Identifiers: Desalting costs.

The purpose of this report is to review the Bolsa Island desalination project supported jointly by the Metropolitan Water District of Southern California, Office of Saline Water, Atomic Energy Commission and three power utilities in the area: The project called for an overall system with seawater desalting plant of 150 mgd capacity and a nuclear power plant with a projected output of 1900 mw. The project was terminated before any construction was started. However, extensive plant, site and economic studies were completed. This report reviews these activities with particular emphasis on cost projections for the plant and resulting water cost. Special features of the report are the man-made island to be used as a plant site (opposite Bolsa Chica State Park), the combined nuclear power desalting system, projected designs for flash distillation plant, the water delivery system and the detailed cost analysis made. (Sieveka-Office of Saline Water)
W71-03915

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVE SION PLANTS,
Powell (Sheppard T.) and Associates, Baltimo Md.
Frank C. Di Luzio, John W. Heintz, and Charles L Gransee.
Available from NTIS as PB-194 028, $0.95 microfiche. For sale by the Superintendent Documents, U. S. Government Printing Offic Washington, D.C. 20402. Price $1.75. Office Saline Water Research and Development Progr Report No. 168, Dec. 1965. 258 p, 497 ref. OS Contract 14-01-0001-378.

Descriptors:
Identifiers: *Desalting, *Water supply, *Wat reclamation, Desalting, *Sewage, Water reclam tion, Water treatment, Oceans, Brackish water, Oy idation, Coagulation, Adsorption, Sewage trea ment, Water resources, Industrial wastes, Microo ganisms, *Waste water treatment.

Experience in the development of saline water con version facilities has clearly established the im portance of water quality to the technology an economics of process and plant design. The overal objective of the investigation has been to determin the effects of contaminated raw water supplies o conversion processes, and to study potentia technical and economic advantages of combinatio saline water and sewage effluent conversion plants The nature of the project has been that of an en gineering study and evaluation, and did not involv any experiments to determine water quality effects Sources of saline water are considered individually and include ocean waters, coastal harbors and estuaries, and saline groundwaters. (See also W70-01545)
W71-03916

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
Gulf General Atomic, San Diego, Calif.
For primary bibliographic entry see Field 05D.
W71-04185

SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
Universal Desalting Corp, New York.
R. B. Cox, G. A. Matta, A. S. Pascale, and K. S. Stromberg.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Price $1.50. Office of Saline Water Research and Development Progress Report No 592, May 7, 1970. 128 p, 20 fig, 3 ref, 3 append. OSW Contract 14-01-0001-2247.

Descriptors: Design criteria, Dropwise condensation, Films, Pilot plants, Evaporation, *Heat transfer, Distillation, *Desalination.
Identifiers: Experimental data, Extended heat transfer surfaces, Film evaporation, Film condensation, Heat transfer improvements, Boiling promotion, Heat transfer coefficients, *Horizontal tube evaporators, *Multiple effect distillation, Non-condensable removal.

A single-effect test unit at the OSW Wrightsville Beach Plant as described in OSW R and D Progress Report No. 492 has been automated for continuous operation. Data obtained during previous short-duration tests were confirmed by continuous operation and by a specific 500-hour run. The factors that influence the overall heat transfer coefficient were further delineated. The effect of various surface enhancements on the heat transfer coefficient was determined and coefficients two to three times those in LTV smooth tubes were obtained. A 3-effect test unit was designed to determine the parameters associated with inter-effect operation and to demonstrate the adequacy of designs for larger sized plants. The report contains a description of this 3-effect test unit together with a discussion of the operating parameters and design innovations to be demonstrated future tests.

4220

USE OF AMALGAM ELECTRODES TO URE ACTIVITY COEFFICIENTS IN TICOMPONENT SALT SOLUTIONS,
Labs., Inc., Waltham, Mass.
imary bibliographic entry see Field 01B.
04221

ICATION OF FELT-MEMBRANE COMTES,
al Aniline and Film Corp., Greenwich, Conn.
rial Products Div.
r C. Wrotnowski, and Edward G. Bernard.
ale by Superintendent of Documents, U. S. nment Printing Office, Washington, D. C. . Price $1.00. Office of Saline Water rch and Development Progress Report No September 1970. 47 p, 20 fig, 5 tab, 26 ref, 4 d. OSW Contract 14-01-0001-2106.

iptors: *Desalination, *Reverse Osmosis, brane processes, *Porous Media, *Porosity, linination apparatus, Osmosis.
ifiers: *Felt-membrane composites, Plate and apparatus, Composite membranes, Mem- compaction.

es were made of felt-membrane composites to mine their suitability for use in the reverse os- desalination process. Impregnated felts were d to have acceptable mechanical and flux mission properties to serve as a membrane ort. A Loeb-type membrane cast on imnated felt was also found to operate normally, ne solution did not 'strike in', the osmotic face porous back formed properly and annealing menable. A Loeb-type membrane cast on imnated felt ran for thirty days (760 continuous ating hours) with the following results: (A) a reduction slope of 0.026 GFD per day. (B) an polated total life of 2.2 years. (C) a steadily oving salt injection. The cost of generating ble water employing an impregnated felt plate frame desalination system was calculated to be follows: (A) one stage brackish water 4/1000 gallons. (B) two stage sea water 8/1000 gallons. (C) one stage sea water 2/1000 gallons. (Horowitz-Office of Saline er)
-04222

ERAL RECOVERY FROM CONCENTED BRINES,
ham Young Univ., Provo, Utah.
primary bibliographic entry see Field 02K.
-04223

E STRUCTURE AND MORPHOLOGY OF INGANIC MEMBRANES,
lor Univ., Waco, Tex.
D. Milligan, M. Uda, M. L. Beasley, Dennis R. in, and Wayne E. Bailey.
sale by the Superintendent of Documents, U. S. ernment Printing Office, Washington, D. C. 02. Price $0.75. Office of Saline Water earch and Development Report No 594, cember 1970. 82 p, 10 tab, 43 fig, 102 ref. OSW nt 14-01-0001-1296.

criptors: *Membranes, *Semipermeable membnes, *Dialysis, Osmosis, Membrane processes, alination.
ntifiers: *Inorganic membranes, Ferrocyanide s, Membrane structure.

e structure and morphology of the classic semimeable membrane, cupric ferrocyanide, and he 40 other heavy metal ferro-, ferri-, and cobalyanides were studied by isobaric dehydration, x- and electron diffraction, low angle electron difction, infra-red, and Mossbauer spectroscopy. shly precipitated cupric ferrocyanide gel was nd to be composed of 10 A amorphous particles t age under water to become crystalline within to 15 minutes. After about 20 hours, platelike particles appear, exhibiting new diffraction lines corresponding to a larger cubic unit cell, and yielding a step-wise dehydration isobar. In the absence of the plates, this cupric ferrocyanide complex exhibits a bivarient dehydration isobar similar to some 30 other cyanide complexes studied. The pore structure of heavy metal cyanide complexes was found to consist of interstices between spheroidal or platelike particles, with the morphology more significant than the particle size. Hydrated cupric ferrocyanide is unique in forming sheets, assumed to be the active semi-permeable structure, water being transported through the channel like interstices, regular in this case, but irregular in membranes composed of spheroidal particles. (Leiserson-Office of Saline Water)
W71-04224

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
Hittman Associates, Inc., Columbia, Md.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.75. Office of Saline Water Research and Development Progress Report No 611, October 1970. 73 p, 10 tab, 23 fig, 16 ref. OSW Contract 14-01-0001-1748.

Descriptors: Desalination, *Reverse Osmosis, Economics, Waste water treatment, *Osmosis, *Membranes, Membrane processes, Costs, Desalination plants, *Revies, *Desalination apparatus, Separation techniques.
Identifiers: Reverse osmosis plants.

The report reviews current technical and engineering economic aspects of the reverse osmosis (RO) desalting process. The RO process is a viable technique for the desalting of brackish water feed. Research indicates that seawater desalting is possible but not yet practical. Brackish water production plants with capacities up to 100,000 gpd are operational. Economical RO desalting is strongly dependent upon the operating performance and economic characteristics of the membrane and its support structure. Much of the attractiveness of the RO process is associated with the low energy consumption requirements. Projections of costs are made for plants up to 50 million gallons per day of product water. (Sturza-Office of Saline Water)
W71-04225

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
Oak Ridge National Lab., Tenn.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $2.00. Office of Saline Water Research and Development Progress Report No 589, September, 1970. 280 p. OSW Contract 14-30-2535.

Descriptors: *Abstracts, *Desalination, Distillation, *Documentation, Indexing, Desalination plants, Desalination processes, Water utilization, Energy, *Bibliographies.
Identifiers: Industrial applications.

Abstracts are given for approximately 1200 published articles related to the desalination of seawater. The body of the report is a copy of information stored in a computerized storage and retrieval system on desalination at the Oak Ridge National Laboratory. The abstracts are grouped in nine categories. Author and keyword indexes to the articles referenced are provided. The keywords, which identify the content of the articles, were chosen from a thesaurus developed at ORNL.
W71-04226

PROGRESS IN WATER DESALINATION TECHNOLOGY,
Desert Inst., Ashkhabad (USSR).
M. V. Kolodin.
Trans From Problemy Osvoyeniya Pustyn', 1970, No 3, p 64-72. Soviet Georgraphy: Review and Translation, Vol 11, No 10, p 858-864, December 1970. 1 fig, 4 tab, 15 ref.

Descriptors: *Water supply, *Desalination processes, *Hydrologic budget, *Cost-benefit analysis, *Water costs, Arid lands, Distillation, Electrodialysis, Flash distillation, Long-tube vertical distillation, Separation techniques, Vapor compression distillation, Energy dissipation, Dual purpose, Electric power production, Evaporators, Economic feasibility, Freezing, Heating, Runoff, Surface waters, Technology, Technical feasibility, Research and development, Water pollution effects, Water utilization, Water reuse, Domestic water, Industrial water.
Identifiers: *USSR, *Atomic reactors.

Originally, human water supply problems existed only in the hot, arid regions, but by the middle of the 20th century, they also existed in highly industrialized urban areas. The earth's annual runoff is 37, 130 cu.km., of which mankind is now using about 10% (3,308 cu.km.), divided between irrigation (2,500 cu.km.) and domestic and industrial uses (563 cu.km.). The major concern is not so much increasing consumption levels as water pollution, and current data suggests that increased pollution will soon create severe water shrotages. Natural water costs are rising as a result of additional treatment needs and diversion from remote areas. It is felt that the solution lies in more thorough treatment processes combined with increasing desalination. Research and development efforts in desalination processes were relatively late in beginning in the Soviet Union, but from 1963-1967, 10 large, producing plants were built, mostly in arid areas. In 1963 the first large 4-chamber long-tube distillation plant was completed at Shevchenko (KazakhSSR) and had a capacity of 5000 cu.m./day, a cost of 143 kopecks/cu.m. and a power consumption of 0.19 billion cal./cu.m. By 1967 a 5-stage flash distillation plant had been built in Krasnovodsk with a capacity of 1200 cu.m./day and a cost of 72 kopecks/cu.m. A secondary refrigerant freezing plant is being designed to have a capacity of 36,000 cu.m./day with a cost of 24.3 kopecks/cu.m. It is felt that dual purpose plants combining saline water conversion with electric power production, are particularly economical. (Casey-Arizona)
W71-04229

DRY LANDS AND A HUNGRY WORLD,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 06B.
W71-04291

3B. Water Yield Improvement

CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
North American Weather Consultants, Pasadena, Calif.

Los Angeles County Flood Control District, Los Angeles, Report 15-1, October 1952. 102 p, 12 fig, 9 tab.

Descriptors: *Cloud seeding, *Cloud physics, *Meterology, *Storm structure, *Artificial precipitation, *Rain, Precipitable water, Weather patterns, Storm structure, Silver iodide, Chemistry of precipitation, Water supply, Storm runoff, Water resources, Hydrologic cycle, Cost-benefit analysis, California.
Identifiers: *Los Angeles County, San Gabriel Mountains.

Cloud seeding methods are discussed for both winter and summer seasons and the economic value of a program is estimated for Los Angeles County. Historical weather records, characteristics of Southern California storms and the physical factors underlying naturally and artificially produced precipitation are examined. Final conclusions and

recommendations are that cloud seeding in Los Angeles County is economically feasible, self supporting, and safe if carried out on a controlled plan basis. It appears that this is true with respect to both winter and summer seeding. It is recommended that cloud seeding be confined to the San Gabriel Range and the desert region to the North thereof in the winter and to the San Gabriel Range in the summer. Furthermore, it is recommended that ground generators be used in winter, and that ground generators be used in conjunction with aerial operations in the summer. Although systematic seeding can be expected to produce precipitation increases of the order of between 20 to 40 percent, a limited seeding plan is recommended. This plan would produce in an average year a minimum of 6500 acre feet of salvable storm flow, worth at least $130,000, plus an additional 20,000 acre feet of sustained summer flow worth over $500,000. (Poertner)
W71-03903

WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
National Weather Service, Silver Spring, Md. Office of Hydrology.
For primary bibliographic entry see Field 02B.
W71-03927

THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02A.
W71-03931

A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
Richard D. H. Low.
Available from NTIS as AD-713 559, $3.00 in paper copy, $0.95 in microfiche. 1970. 13 p, 4 fig, 15 ref.
Identifiers: *Artificial precipitation, Mathematical analysis, *Water vapor, Condensation, Nucleation, Vapors, Diffusion, Integration, Weather modification.

One facet of weather modification is the dissipation of a warm fog or the improvement of visibility within it by means of seeding with condensation nuclei. The analysis of the effectiveness of this type of nuclei finds its roots in the mathematical expression for condensational growth - one of the few fundamental equations in cloud physics which has, only during the past twenty years, been recognized as a distinct branch of physical meteorology and, more recently, as an integral part of atmospheric physics. Being a young science, cloud physics has embodied areas of study which are in need of better understanding and further development, one such area being the processes of condensation and precipitation. The fundamental equation is applicable to the growth of an isolated and immobile saturated solution droplet in a stationary medium of moist air. It is the purpose of this paper to examine this equation critically from a theoretical point of view.
W71-04005

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
California Univ., Riverside. Dry-Lands Research Inst.; and New South Wales Univ., Kensington. School of Civil Engineering.
Warren A. Hall, and David T. Howell.
Journal of the Irrigation and Drainage Division, ASCE, Vol 96, No IR4, p 395-402, December 1970. 8 p, 1 tab, 6 ref, 2 append.

Descriptors: *Optimization, *Stochastic processes, *Linear programming, *Dynamic programming, *Water allocation (Policy), Constraints, Streamflow, Regulated flow.
Identifiers: *Nonlinear system.

An example of the use of water rights as a social constraint was presented for an arid or semiarid agricultural region such as exists in much of the southwestern portion of the United States. It was presumed that the quantity of water which will be available in any year could be assessed with reasonable accuracy at the beginning of the growing season of that year. The particular device used was the allocation of the probability of receiving water rather than the allocation of water per se. First, allocation of stochastic water supply by a linear system was described. A series of linear programming problems, each with one constraint, was shown in tabular form. The use of dynamic programming as an alternate procedure was developed in the section on nonlinear systems. The problem of solving real optimal water-allocation was resolved by allocating the probability of receiving water, i.e., the seniority of the right rather than the water alone. The probability used represented the stochastic component of a stream-flow. Since the method concerned the residual stochastic component, first the net returns from the regulated, or nonstochastic, portion of the flow were produced by the project and then, the difference between the optimal return from the residual unregulated (stochastic) flow and the optimal return from the original unregulated flow were added algebraically so as to make a more precise evaluation of a particular project proposal. No attempt was made to apply the method to a municipal-industrial system. (Kriss-Cornell)
W71-04028

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY: THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 04D.
W71-04230

INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
Jack Rothacher.
Water Resources Research, Vol 6, No 2, p 653-658, April 1970.

Descriptors: *Water yield improvement, *Clear-cutting, *Vegetation effects, Small watershed, Watershed management, Coniferous forest, Mountain forests, Lumbering, Oregon.
Identifiers: *Experimental watersheds.

Increases in water yield following timber harvest roughly conform to the proportion of the area cleared. In high precipitation areas of the Oregon Cascades, clear-cut logging can increase annual water yield 18 inches. Approximately 80% of the increase occurs during the October to March season. (Rothacher-Forest Service)
W71-04240

THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
Ronald D. Tabler.
Hydrology Seminar, University of Wyoming, Proceedings, p 11-15, June 25-26, 1970.

Descriptors: *Research facilities, *Sagebrush, *Snow management, Soil-water-plant relationships, Water yield improvement, Snowpacks, Wyoming.
Identifiers: *Snow fences.

The hydrology of sagebrush lands and the effec sagebrush control on water yield are being stu by the Rocky Mountain Forest and Range Exp ment Station at the Wayne's Creek Watersh (elev. about 9500 ft) near Dubois, Wyoming, at the Stratton Study Area (elev. about 7500 near Saratoga. At both of these areas, waters of 60 to 1600 acres are instrumented for stre flow, precipitation, snow storage, sediment yi soil moisture, climatic data, and vegetative prod tion and ground cover. On the Pole Moun Study Area, near Laramie, snow fences are be tested as a means of increasing snow accumulat and snowmelt runoff. A snow fence 12 1/2 ft and 1300 ft long, built during the summer of 19 is expected to about double snow accumulation the 111-acre watershed. Effects of this treatm on snow accumulation, total annual streamfl and seasonal distribution of flow will be stud over the next five years. (Tabler-Forest Service)
W71-04248

SUMMARY OF SNOW RESEARCH BY T ROCKY MOUNTAIN FOREST AND RANGE E PERIMENT STATION AT LARAMIE, WYO ING.,
Forest Service (USDA), Laramie, Wyo. Roc Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W71-04249

WATERSHED MANAGEMENT IN THE UNITE STATES: CONCEPTS AND PRINCIPLES,
Forest Service (USDA), Logan, Utah. Intermou tain Forest and Range Experiment Station.
P. E. Packer, and W. A. Laycock.
New Zealand Agr Eng Inst, Lincoln College, Ca terbury, New Zealand, Lincoln Papers in Wat Resources No 8, Part 1, p 1-22, 1969. 60 ref.

Descriptors: *Water yield improvement, *Wat quality, *Water yield, *Watershed manageme *Watersheds, Phreatophytes, United States.
Identifiers: *Watershed protection, *Watersh rehabilitation, Forest watersheds, Ran watersheds.

Without doubt, the most important watersh problems for which management solutions a needed are those concerned with how to contin timber harvesting, grazing, mining and recreation uses of watersheds without causing undue dama to soil and water. Increasing pressures from an e panding population for the multiple uses afforde by our forest and range watersheds emphasize th need for accelerated research to provide answe and for more intensive management application those answers. Of more immediate danger to so and water are those problems concerned wit restoration of satisfactory hydrologic and soil st bility conditions to damaged watersheds; howeve these problems are not nearly so widespread as and, therefore, are not of equal importance with the watershed maintenance problems. Not only research needed to further develop and refin requirements for such restoration but manageme must also demonstrate greater willingness to mak the investments necessary to rectify damaging e fects on soil and water of past misuses and abuse Finally, of somewhat less urgency--but neverthele of still great importance--are those problems con cerned largely with manipulation of vegetation t influence the amount, quality, and timing of wate yields delivered as streamflow from forest and range watersheds. (Packer, Forest Service)
W71-04253

3C. Use of Water of Impaired Quality

IMPROVING EFFICIENCY IN AGRICUL TURAL WATER USE,
Colorado State Univ., Fort Collins. Natural Resources Center.
W. D. Kemper.

able from NTIS as PB-197 264, $3.00 in copy, $0.95 in microfiche. Completion Re- Series No 20, Environmental Resources r, July 31, 1970. 10 p. OWRR Project B-008- (12).

iptors: *Evaporation, *Salinity, Soil texture, ce crusts, Salt tolerance, *Osmosis, Electro- sis, Hysteresis, Dispersion, *Saline soils, Soils. fiers: Dispersion coefficients, Onsager ocal relations, Gravel mulches, Wetting ods, Salt gradients, Anomalous osmosis.

ty is a factor in most of the western soils. oration of water in the soils leaves the salt ntrated in the remaining solution, building up concentration gradients even in soils contain- elatively low concentrations of total soluble These salt gradients can affect water move- both by acting osmotically and by changing il structure and water absorption capabilities. mechanisms of osmosis were delineated, odynamic dispersion coefficients were deter- d, and effects of these salt gradients on oration were determined. NaCl decreased orative CaCl2 tended to increase evaporation. dense crusts of the type formed by raindrop n tended to reduce evaporation when overly- oser soil with larger pores. The mechanisms mosis are so involved with ion type, mineral structure, and texture that much more work is ed to sort out all the interactions and develop ctive criteria.
-04049

GRESS IN WATER DESALINATION HNOLOGY,
rt Inst., Ashkhabad (USSR).
rimary bibliographic entry see Field 03A.
-04229

Conservation in Domestic and Municipal Use

TUDY OF WATER USE IN SINGLE- LLING RESIDENCES IN THE CITY OF GARY, ALBERTA, ALBERTA UNIV., ED- NTON (CANADA),
rto Univ., Edmonton. Dept. of Agricultural omics and Rural Sociology.
ard L. Kellow.
ersity of Alberta Agricultural Economics and l Sociology, Ph D Thesis, Thesis Report, No 1, 1970. 175 p, 29 tab, 12 fig, 67 ref, 2 append.

riptors: *Municipal water, Domestic water, er rates, Measurement.
tifiers: *Calgary.

ugh random sampling of domestic water con- ers in Calgary, Alberta the author was able to the effect of flat rate versus metered rate r pricing systems. He concluded that eholds on a flat rate average substantially ter water use than metered households. The also revealed the existence of a large variance ater consumption between households in the socio-economic class, but the seasonal peak- ncreases faster than average water use as the e of the home and income increases. (Holmes- ers)
-04287

Conservation in Agriculture

ELOPMENT OF ECONOMICAL METHODS BORON REMOVAL FROM IRRIGATION URN WATERS,
bjet-General Corp., El Monte, Calif.
primary bibliographic entry see Field 05D.
-03914

INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
South Dakota State Univ., Brookings. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02D.
W71-03925

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 08B.
W71-04007

ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
Memorial Univ. of Newfoundland, St. John's. Dept of Geography.
Peter Crabb.
Scottish Geographical Magazine, Vol 86, No 1, p 41-51, April 1970. 4 fig, 3 tab, 18 ref.

Descriptors: *Citrus fruits, *Irrigation systems, *Crop production, *Marketing, *Economic efficiency, Semiarid climates, Temperature, Environmental effects, Irrigation effects, Salinity, Economic feasibility, Distribution systems, Sprinkler irrigation, Productivity, Fruit crops, Grapefruit, Oranges, Cost-benefit analysis, Water utilization, Land use, Labor, Costs, Quality control.
Identifiers: *South Australia, *Production costs.

Australia is not as yet a major citrus producing country, and South Australia accounts for only 25% of Australian citrus production. In the past 20 years, however, the rate of increase of citrus production has been far greater in South Australia than any other state and still has much potential citrus land currently unexploited. The quality of the citrus is also high. South Australia's major advantages are extensive irrigation schemes and freedom from insect pests due to climatic aridity and very stringent quarantine regulations. However, several problems are beginning to develop: (1) increasing production bringing a rising proportion of poor-quality fruit due to greater numbers of young trees, (2) a temperature regime unfavorable for grapefruit production, (3) overuse of N fertilizers, (4) salt accumulation owing to application of highly saline Murray River water by overhead sprinkler systems, (5) high labor costs, (6) decreases in world citrus prices, (7) inefficient packing and handling practices, and (8) inefficient distribution and marketing systems. Recently legislation has been passed creating a Citrus Organization Committee, which is concentrating on improved administration of the industry, collection of statistical and technical data, and marketing. The prognosis for the future is highly favorable. (Casey-Arizona)
W71-04051

GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
K. V. Dolgopolov.
From: Izvestiya Akademii Nauk SSSR, Seriya Geograficheskaya, 1969, No 6, p 38-46. Soviet Geography: Review and Translation, Vol 11, No 9, p 737-745, November 1970. 4 tab, 15 ref.

Descriptors: *Water conservation, *Water supply, *Competing uses, *Irrigation practices, *Industrial water, Crop production, Economic feasibility, Semiarid climates, Cost-benefit analysis, Planning, Soil conservation, Grains (Crops), Geographical regions, Water resources, Regional analysis, Productivity, Water allocation (Policy), Water distribution (Applied), Water costs, Water pollution effects, Water requirements, Water users, Irrigable land, Wheat, Agriculture, Water demand.
Identifiers: *USSR.

The steppe and wooded steppe regions of the eastern USSR play a key agricultural role, producing over 80% of the nation's grain crop. In terms of total yield, yield/acre, production costs and direct labor inputs, they are far superior to Siberia and Kazakhstan. As part of a national program of increasing agricultural production, present plans call for an increase of almost 100% in grain production in the steppe areas. However, these regions are characterized by an unstable water supply. In the wooded steppe this problem can be alleviated by improved water and soil conservation measures, but in the steppe zone, irrigation will be absolutely necessary. This problem is complicated by the presence of a large number of high water-use industries in these zones. The author argues that the requirements of agriculture should be given priority in these areas and the practice of industrial location in highly agricultural regions should be discontinued. The far eastern regions of the USSR have no agriculture and are water-rich, and would therefore be much better industrial areas. (Casey-Arizona)
W71-04052

FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
Birmingham Univ. (England). Centre for West African Studies.
W. B. Morgan, and R. P. Moss.
Erdkunde, Vol 24, No 1, p 71-80, Marz 1970. 6 fig, 2 tab, 16 ref.

Descriptors: *Grasslands, *Forests, *Farm management, *Crops, *Economic feasibility, Social impact, Ecosystems, Ecology, Environmental effects, On-site data collections, Biological communities, Human population, Tropical regions, Rainfall, Temperature, Climatic data, Drought tolerance, Soil types, Soil chemical properties, Biogeography, Land development, Grasses, Vegetation, Soil surveys, Urbanization, Humid climates, Rice, Tobacco, Water utilization, Agriculture, Variability, Spatial distribution.
Identifiers: *West Africa, *Nigeria, *Cassava, *Developing countries, *Agroclimatology, Cocoa, Yams, Bananas, Location factors.

Crop plants alter their environment and are in turn acted upon by the environment. For this and other reasons, it is argued that agricultural development planning and descriptions of spatial variability should not proceed only on the basis of simple surveys of native vegetation. In Western Nigeria the savanna-forest boundary is not abrupt. Islands of forest extend for a considerable distance into the savanna. A survey of farm holdings was conducted in 1966, in the hope that it would reveal some of the factors involved in crop choices, particularly on holdings which included both forest and savanna land. The physical factors of temperature, rainfall, natural vegetation and year-round growing conditions are described, as are the social factors of farm sizes and locations relative to towns, land ownership, labor problems and the general impact of urbanization on rural areas. Commercial crops were much more extensive than crops for domestic consumption, and were shipped to the cities. Cocoa was the dominant crop in forest areas and cassava was dominant in savanna areas. The 3 major crops systems were: (1) root crops - banana-tree crops, confined to the forest, (2) maize-cassava-yams, occurring in both areas and (3) Guinea corn-root crops system, confined to the savanna. Other crops such as rice and tobacco occurred only in areas where appropriate processing facilities were available. Forest land clearance presents a major problem because of the rainly seasons. Relatively moist areas are used for growing high-priced yams where economically feasible. It is concluded that crop choices are made on the basis of a variety of economic, social and biological factors and no simple distinction occurs between forest and savanna agriculture. (Casey-Arizona)
W71-04054

FEEDING A DESERT CITY: ANTOFAGASTA, CHILE,
Southern Connecticut State Coll., New Haven. Dept. of Geography.
Martin I. Glassner.
Economic Geography, Vol 45, No 4, p 339-348, October 1969. 2 fig, 5 tab.

Descriptors: *Arid lands, *Food abundance, *Economic feasibility, *Transportation, *Social aspects, Legal aspects, Deserts, Urban sociology, Import, Moisture availability, Geographical regions, Social impact, Harbors, Railroads, Distribution, Access routes, Roads, Road construction, Moisture deficit, Food habits, Climatic zones, Highway effects, Environmental effects, Limiting factors, Area development, Federal government, Attitudes, Industries, Public health, Social change, Water demand, Livestock, Prices, Agriculture.
Identifiers: *Chile, *Atacama desert, *Oases, *Antofagasta.

Antofagasta is a seaport in the heart of the Atacama, perhaps the world's driest desert. Since the only food production in the Atacama is at scattered oases, the city, with a population of 125,000, has severe food import problems. It is, however, favored by an abundant supply of fresh water and special import privileges. The major sources of food supply are: (1) imports, both from within and outside of Chile via ship, railroad and truck, (2) produce grown at the interior oases, (3) seafood acquired by inefficient, primitive methods and (4) livestock grown in limited numbers within the city. Food prices are generally high and most of the population suffers from an inadequate diet. A special law allows into the province a large number of foreign food imports forbidden to the rest of the country. The imports are taxed and the revenue is used in various projects designed to improve the food supply. These include modernization of the fishing industry and oasis agriculture, improvement of transport facilities to the city and improvement of food storage and distribution facilities within the city. Counterparts of this city are found in ill-fed desert communities around the world and it is hoped that its experiences will serve as guidelines to other areas beset by the problems of severe water-deficiency. (Casey-Arizona)
W71-04055

SUPERFARMS VS. SAGEBRUSH: NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
Portland State Univ., Oregon.
David Lawrence Smith.
Association of American Geographers, Proceedings, Vol 2, p 127-131, 1970. 9 ref.

Descriptors: *Irrigation practices, *Land reclamation, *Crop production, *Pumping, *Social change, Desert Land Act, Irrigation systems, Irrigation efficiency, Idaho, Alfalfa, Potatoes, Sugar beets, Sorghum, Barley, Arid lands, Sagebrush, Sands, Sprinker irrigation, Flood irrigation, Irrigation ditches, Land development, Political constraints, History, Legal aspects, Social aspects, Irrigable land, Water delivery, Farm management, Potations, Farm units, Cost benefit analysis, Economic feasibility, Economies of scale, Economic prediction, Federal government, Rivers, Flood plains.
Identifiers: *Bureau of land management, *Bureau of reclamation, *Snake River.

Most of the Snake River Plain is traversed by the River in a narrow canyon up to several hundred feet deep; only occasionally does the canyon widen enough for a flood-plain. The natural vegetation is a sagebrush-grass association and all environmental factors except rainfall are favorable for crop production. Irrigation projects in the area were started over 100 years ago and until 1950 were largely a result of federal involvement. Since 1950 the combination of crop prices, technical improvements in water pumps and private investment have resulted in a steady increase of land reclamation by pumping water several hundred feet up onto the plain from the Snake River. This has resulted in large, isolated farming units usually in absentee ownership. The older farms are smaller, family-oriented, require less capital and often occupy federal reclamation projects. The major crops are potatoes, barley and sugar beets. The success of the large-scale operations since 1960 ensures an adequate source of private development capital. Most of the currently undeveloped land is owned by the federal government and its acquisition by private groups has been complicated by legal and political factors. Water supplies for support of future developments seem adequate. The author forsees a doubling of irrigated land in the future. (Casey-Arizona)
W71-04056

THE SAM SIMON WATERSHED: SHRUB CONTROL,
Arizona Univ., Tucson. Coll. of Agriculture.
Gilbert L. Jordan, and Michael L. Maynard.
Progressive Agriculture in Arizona, Vol 22, No 5, Sept-Oct 1970, p 6-9. 6 fig, 2 tab, 3 ref.

Descriptors: *Soil management, *Watershed management, *Range management, *Brush control, *Vegetation regrowth, Plant populations, Shrubs, Phreatophytes, Erosion control, Arroyos, Soil-water-plant relationships, Gullies, Forage grasses, Soil moisture, Germination, Root systems, Mechanical control, Mesquite, Droughts, Arizona, Arid lands, Grazing, Planting management, Cacti, Desert plants, Watersheds (Basins), Competition, Balance of nature, Equipment.
Identifiers: *Perennial grass cover, Pitted chaining, Disk plowing, Root plowing, Seedling, San Simon Valley (Arizona), Semiarid lands, Creosotebush.

The San Simon Valley, a frail watershed in southeastern Arizona, is subject to excessive soil movement and arroyo formation as a result of mismanagement, over-grazing and drought. This semiarid region (less than 9.5 inches annual precipitation) is dominated by shrubs, mainly sand-dune mesquite, creosotebush and tarbush. Perennial grass cover is composed of sideoats, grama, black grama, bush muhly, spike and mesa dropseed, sacaton, Arizona cottontop, plains bristle-grass, and cane beardgrass. Vegetation improvement for erosion protection and increased forage production requires shrub removal and grass planting. Shrub removal is necessary in semiarid rangelands because shrubs use limited moisture necessary for seedling establishment and germination. Brush control study sites were selected from typical cattle-grazed rangeland and were subsequently fenced. The Bowie site has creosotebush and sand-dune mesquite communities. The communities have extensive lateral root systems and deep tap roots, which collect windblown sand. The San Simon site has communities of sand-dune mesquite, creosotebush, tarbush, and four-wing saltbush. Seeding studies, mechanical shrub control and complete to moderate brush eradication were performed during the 1963 to 1966 period. Fourwing saltbush, a palatable browse plant, was not well controlled. Soil moisture was an important factor in brush control, since mechanical control tends to be more effective when moisture is low. Root and disk plowing and pitted chaining effectiveness is shown in two tables; six photographs show typical vegetation and shrub control techniques. (Popkin-Arizona)
W71-04058

ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
Arizona Agricultural Experiment Station, Yuma; and Arizona Agricultural Experiment Station, Phoenix, Salt River Valley Citrus Farm.
D. R. Rodney, R. M. Allen, and R. H. Hilgeman.
Progressive Agriculture in Arizona, Vol 22, No 5, Sept-Oct 1970, p 10-11. 2 fig, 2 tab.

Descriptors: *Oranges, *Lemons, *Citrus fruits, *Crop response, *Plant diseases, Boron, Chlorine, Iron, Nutrients, Fruit crops, Loam, Fungi, Viruses, Growth stages, Salts, Irrigation water, Saline wa Calcium, Soil types, Irrigated land, Arizona, A lands, Dissolved solids, Resistance, Plant gro Sands, Crop production.
Identifiers: *Rootstocks, *Adaptivity, Irrig crops, Zinc, Aphids.

Irrigated citrus fruits are an important crop Arizona. Factors which complicate selection rootstocks for citrus trees are physical cha teristics of calcium content and soil, salts in th rigation water, rootstock adaptation to soil, c um, salts and responding growth and fru responses, and rootstock tolerance to viral and gal diseases. The major cause of citrus tree de in Arizona is root rot or brown rot gumm caused by the fungus Phytophtora. Very viruses causing tristeza are present in Ariz though aphid populations are seasonly commo chart shows advantages and disadvantages of common rootstocks for Valencia oranges Lisbon lemons. Rough lemon scions produce l yields on sandy soils and loam of large fruit large total soluble solids. A susceptibility c describes tolerance to quick decline, cache scaly butt and foot rot as well as nutrient tolera of 10 common rootstocks. Expected rootst responses to iron and zinc deficiencies, chlorine and boron excesses are also indica (Popkin-Arizona)
W71-04059

ELEVATION AND TEMPERATURE EFFEC ON SEVERITY OF MAIZE DWARF MOSA VIRUS IN SORGHUM,
Arizona Univ., Tucson. Coll. of Agriculture.
R. B. Hine, W. E. Osborne, and R. E. Dennis.
Progressive Agriculture in Arizona, Vol 22, N Sept-Oct 1970, p 14-16. 1 fig, 3 tab, 12 ref.

Descriptors: *Elevation, *Air temperatu *Viruses, *Sorghum, Irrigated land, Parasiti Plant diseases, Johnsongrass, Arizona, Arid lan Environmental effects, Temperature, Resistan Crop production, On-site investigations, C response, Moisture.
Identifiers: *Maize Dwarf Mosaic Virus (MD *Irrigated crops, *Disease severity, *Crop los *Hybrids, Aphic vector populations, Coch County (Arizona).

Sorghum is one of Arizona's most important rigated crops. During 1968 and 1969, 200,000 rigated acres were grown at elevations from n sea level to over 5,000 feet, equally divi between the southeastern and central parts of state. Full season hybrids, planted at high ele tions in May and harvested in October a November, exceeded 6,000 pounds per acre-abo the state average of 4,400 pounds. Sorghum grown without serious parasitic diseases until Maize Dwarf Mosaic (MDM) virus epidemic 1968 extended to all producing counties. Seri losses were caused only at elevations over 4,0 feet in 1968 and 1969. MDM outbreak in Coch County in 1968 was related to high aphid vec populations, Johnsongrass prevalence, unusua cool summer and large acreages planted susceptible hybrids. This paper explains differen in disease severity at different elevations and tim Several replicated field plots established in areas various elevations were evaluated in sorghu response to MDM. High summer temperatures a use of resistent hybrids reduced disease severity the 1969 field studies. Observations from 1967 1970 show low air temperatures related to serio disease development in susceptible hybrids. MD was serious only aboe 4,000 feet only during t cool 1968 summer, though MDM was common low elevations during this period. Aphid and Joh songrass control is expensive and difficult. Te perature is uncontrollable and unpredictab Hybrid choice, controlled by the grower, is t means of MDM control. Figures and tables sh field test results, temperature comparisons a elevation temperature relationships. (Popki Arizona)
W71-04060

RALOGY OF SOME ARID AND ARID LAND SOILS OF IRAQ,
nsin Univ., Madison. Geological and Natural y Survey.
imary bibliographic entry see Field 02G.
04061

ATE AND OVERGRAZING ON THE TO PLATEAU, ARIZONA,
a Univ., Edmonton.
Campbell.
sional Geographer, Vol 22, No 3, p 132-141, 970. 5 fig, 3 tab, 30 ref.

ptors: *Grazing, *Arid lands, *Climatology, tation effects, *Arizona, Arroyos, Precipita- Atmospheric), Vegetation establishment, Cli- data, History, Environmental effects, Ecolo- heep, Temperature, Indian reservations, ochronology, Erosion, Drought, Biological unities, Sagebrush, Grasses, Shrubs, Plant ations, Canyons, Gully erosion, Topography, ll disposition, Elevation, Ecosystems, Carry- capacity, Variability, Data collections, al, Livestock, Soil erosion.
iers: *Shonto Plateau (Arizona), *Vegeta- nes, Plant pests, Russian Thistle.

honto Plateau area of northern Arizona un- es wide annual temperature variations but has ng grazing potential because of a double- um annual precipitation pattern. Due to a y-old grazing history and a record of climatic patterns in the middle and late 19th century the 1930's, the area may lend clues to the ol- roblem of the Southwest--the nature of the of overgrazing and climatic change on na- egetation and arroyo-cutting. The Bureau of Affairs, which administers the area, has sized the them of overgrazing-vegetation- ction-soil erosion without giving considera- climatic variability. The area is now covered re stands of Russian thistle (Salsola kali), documentary evidence indicates did not ap- ntil the 1920's in any high numbers. Probably originally encouraged by favorable moisture ions, and when overgrazing and aridity cy- ombined to reduce competition from native s, it became dominant. Many gully existent in 930's no longer exist or are stablized. Ap- y, overgrazing has not resulted in accelerated erosion. Some climatic factor, possibly er rain intensity, is probably presently un- ble for gully formation. (Casey-Arizona)
04064

ER TABLE DECLINE AND RESULTANT CULTURAL PATTERNS IN THE SALT R VALLEY OF ARIZONA,
s State Coll. of Pittsburg. Dept. of Geog-
n Pifer.
al of Geography, Vol 68, No 9, p 545-549, nber 1969. 2 fig.

iptors: *Water table, *Arizona, *Withdrawal, ation practices, *Agriculture, Crop produc- Economic feasibility, Arid lands, Irrigation Water allocation (Policy), Groundwater g, Groundwater recharge, Groundwater , Pumping, Irrigation districts, Developed s, Cost trends, Cost-benefit analysis, Grains s), Cotton, Citrus fruits, Forages, Water Allotments, Alfalfa, Deep wells, Aquifers, um, Water resources, Wells, Legislation, es, Gravitational water.
fiers: *Salt River Valley (Arizona), *Salt Project, *Groundwater Act (Arizona), s.

ater resources of the Eastern Salt River Val- Arizona have been intensively developed, ing in the conversion of unproductive desert ensive croplands. However, this vast develop- was sustained by large scale groundwater awals and in the past 30 years the water level eclined from 100 feet to approximately 475 elow the surface, although some gravity water is now available from the Salt River Project and no new irrigation wells have been drilled in critical areas since the Groundwater Act of 1948. Farms in the area obtain water from different sources with varying costs and accordingly, grow differing crops. The 3 crop-water source classes are: (1) irrigation districts supplied by both well and gravity water at an average cost of 10 dollars/acre-foot growing small grains and forage crops; (2) irrigation districts supplying pumped water with high initial cost citrus orchards and grapes which provide high cash returns and (3) privately owned and operated wells where water costs run as high as 15 dollars/acre-foot, growing cotton and potatoes. As water costs increase, more farmers turn to higher value crops. Probably the marginal areas will be abandoned as water costs become too great to produce cotton and potato crops economically. (Casey-Arizona)
W71-04065

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
Agricultural Research Service. Northern Plains Branch; and Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 02G.
W71-04068

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
Muskegon County Board, Mich. Dept. of Public Works.
For primary bibliographic entry see Field 05D.
W71-04186

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN: ORGANIZATION AND MANAGEMENT,
Leeds Univ. (England). Dept. of Agricultural Economics.
I. G. Simpson.
Land Economics, Vol 46, No 3, p 287-296, August 1970. 2 tab, 3 ref.

Descriptors: *Crop production, *Social impact, *Economic efficiency, *Irrigation systems, *Land tenure, Land use, Land management, Social aspects, Economic feasibility, Farm units, Foreign countries, Administrative agencies, Administrative costs, Irrigation water, Arid lands, Manpower, Political aspects, Cooperatives, Leases, Pumping, Water costs, Rent, Cotton, Planning, Irrigation districts.
Identifiers: *Sudan, *Developing countries, Nile River, Gezira System.

The principal irrigated areas of the Sudan lie along the Blue and White Nile Rivers, and several new projects are currently in the planning stages. The oldest irrigation scheme is the gravity-fed Gezira of about 2 million acres, which was established by the British in 1913. The social and political organization of land tenancy, land development and water provision became an amalgam of state control and private enterprise known as the 'Gezira System'. Tenants are allocated holdings of a fixed number of acres and the holding rights are inheritable. To facilitate mechanized operations and close supervision, the holdings consist of a number of strips in separate fields which were originally only cotton fields. The management of the scheme is highly centralized, and uniform regulations for cropping decisions, land management practices, etc., are not determined at the local level. This results in administrative cost efficiencies, but introduces little progress because of inertia through lack of incentives to individual tenants, conservative decision-making and lack of emphasis on technical leadership. Innovation and flexibility are therefore lacking. Further, population numbers have increased faster than holdings, creating a downward pressure on sizes of individual holdings. In early days of the scheme, the communal system was successful, but the author feels it has outlived it's usefulness. A careful analysis here should furnish guidelines for the organization of future water project schemes. (Casey-Arizona)
W71-04231

IRRIGATION DEVELOPMENT IN TUNISIA,
California State Coll., Long Beach. Dept. of Geography.
Edward Karabenick.
Tijdschrift voor Economische en Sociale Geografie, Vol 60, No 6, p 360-368, November/December 1969. 3 fig, 12 ref.

Descriptors: *Salinity, *Irrigation systems, *Irrigation practices, *Crop production, *Developed waters, Social aspects, Social impact, Political aspects, Cost-benefit analysis, Planning, Evaluation, Environmental effects, Irrigation effects, Dams, Urbanization, Groundwater, Regional analysis, Watersheds (Basins), Administrative agencies, Arid lands, Droughts, Water allocation (Policy), Water districts, Water policy, Water quality, Water resources, Water supply, Water users, Salinity, Farms, Agriculture, Municipal water.
Identifiers: *Tunisia, *Developing countries, *Mejerda River, *Agricultural development, Grapes, Olives.

Although it is a major sector of the Tunisian economy, farming is overburdened by technological immaturity and population pressures. Most of the country is arid, and even the narrow, humid coastal band is subject to periodic droughts. The Mejerda River drainage basin represents 60% of the nation's total irrigation potential, but because of unfavorable terrain, only the upper and lower parts of the Mejerda Valley are suitable for agricultural redevelopment. Because of physical and social factors, development efforts have differed in the 2 areas. Owing to its proximity to the rapidly expanding Tunis area, the lower valley, has lost much water to the Greater Tunis water system. Saline water and saline soils are critical problems limiting crop potential. Agrarian reform has resulted in the evolution of private ownership, and a large number of cooperative village settlements have been built. While the irrigated area of the upper valley will not be as great, it may be more productive. The available surface water of the northern Mejerda tributaries may be supplemented by groundwater resources and large cooperatively owned farms are being developed. The division in administration between the 2 valleys has not abetted coordinated planning of total Mejerda basin development. Further, the uneconomic aspects of a third development, the Oued Nebaana Project, indicate the importance of political as well as economic factors. (Casey-Arizona)
W71-04232

AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
Economic Research Service, Fargo, N. Dak.
Wallace McMartin, Howard J. Haas, and Wayne O. Willis.
Conservation Research Report No 14, USDA, March 1970. 21 p, 6 fig, 11 tab, 23 ref.

Descriptors: *Irrigation practices, Water conservation, Snow management, Alfalfa, Economics, *Cost-benefit analysis, North Dakota, *Forages, Agronomic crops.
Identifiers: *Northern Great Plains, Mandan (N Dak), Level bench systems.

Economic benefits to be gained by constructing a level bench system for growing several field crops in North Dakota are described. Since the Northern Great Plains is a dry area, these level benches would serve to conserve the snow so that it could be added to the available water supply for the crop. At the Northern Great Plains Research Center at Mandan, North Dakota, level bench experiments were conducted with various crops, with various width benches, on various gradients of slopes. This paper reports that financial returns for alfalfa

grown with level benches are considerably increased, while for grass, wheat and corn either small benefits or none at all were found. (Holmes-Rutgers)
W71-04265

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
Colorado State Univ., Fort Collins.
Melvin D. Skold, and Arthur J. Greer, Jr.
Colorado State University Experiment Station, Technical Bulletin 106, October 1969. 24 p, 2 fig, 13 tab, 21 ref.

Descriptors: *Planning, *Water management (Applied), *Water conservation, *Economic impact, *Input-output analysis, Resource development, Linear programming, Computer programs, Computer models, Water supply, Irrigation efficiency, Irrigation programs, Consumptive use, Expenditures, Water allocation (Policy), Economic prediction, Estimating, Kansas, Colorado, Great Plains, Model studies, Analytical techniques, Income, Agriculture, Farms.
Identifiers: *Agricultural change, *Great Plains Conservation Program, Semiarid lands.

An input-output local economic model was constructed for a 9-county area in northwestern Kansas and east-central Colorado--a semiarid, groundwater irrigation, agricultural region. Impact of irrigation development on agriculture is analyzed by a recursive linear programming model. Irrigation development produces additional purchases of processing services, capital inputs and retail items. The derived demands for these agricultural services become inputs to the input-output model which estimates irrigation-development impact. The region, the analytical model and model applications are discussed. The Great Plains Conservation Program and irrigation development produced marginal changes in income and additional consumer expenditures in accord with the marginal propensity to consume. Unless regional income change is major, the number of firms and volume of employment will not increase greatly. This analytical techniques may be applied to other areas to analyze resource development and programs and yield useful results. Thirteen tables present input-output data. (Popkin-Arizona)
W71-04289

IRRIGATION AS A FARM GROWTH STRATEGY,
North Dakota State Univ., Fargo. Dept. of Agricultural Economics.
Carl E. Olson, and Joseph H. Paulson.
North Dakota Agricultural Experiment Station, Bulletin 486, October 1969. 11 p, 2 fig, 12 tab, 5 ref.

Descriptors: *Farm management, *Irrigation efficiency, *Water resources development, *Economic efficiency, *Water conservation, Net income, Dry farming, Income analysis, Farm prices, Pasture management, Livestock, Irrigated land, North Dakota, Surveys, Economic impact, Gross income, Variability.
Identifiers: *Economic growth, *Economic survival, *Income stability, Interviews, Questionnaires, Lower Yellowstone Soil Conservation District (North Dakota), Garrison Diversion Project (North Dakota), Semi-arid lands.

Irrigated farming in semiarid regions increases chances of survival and economic growth. This report compares and evaluates organizational and operational strategies of irrigation, livestock and mixed farm-operator groups in North Dakota. The development of Garrison Diversion Project encourages interest in irrigation in the state. The Lower Yellowstone Soil Conservation District with 39,088 irrigable acres, is studied by way of 89 questionnaires to operators and follow-up interviews. Mixed or livestock groups have a greater positive change in net worth and a higher rate of economic growth than the irrigation group. Mixed and livestock groups operated more variable and diversified farms, with similar amounts of irrigated acreage, dry cropland and pasture acreage. Irrigated enterprises on a dryland operation add stability to income and increase the economic growth rate. Figures and tables locate the study area and correlate gross farm income, type and total acreage, and assets for irrigation, livestock and mixed groups. (Popkin-Arizona)
W71-04290

THE PUMPED WELL,
Colorado Agricultural Experiment Station, Fort Collins.
For primary bibliographic entry see Field 04B.
W71-04292

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
Charles O. Hopkins, and Vernon R. Eidman.
Oklahoma Agricultural Experiment Station, Project 1358: Economic Efficiency in the Allocation of Irrigation Water Over Time. Oklahoma Agricultural Experiment Station, Agricultural Research, Processed Series P-600, January 1969. 74 p, 1 fig, 70 tab, 26 ref.

Descriptors: *Crop production, *Irrigation efficiency, *Economic justification, *Economic prediction, *Oklahoma, Farm management, Cultural control, Cultivation, Irrigable land, Irrigation practices, Water management (Applied), Water requirements, Fertilization, Planting management, Cost allocation, Decision making, Limiting factors, Water allocation (Policy), Water supply, Water demand, Water costs, Water shortage, Economic efficiency, Economic impact, Unit costs, Prices, Leases, Resource development, Return (Monetary), Operating costs, Groundwater, Productivity, Cost benefit analysis, Irrigation systems.
Identifiers: *Resource requirements, Custon rates.

Estimates of costs and returns for groundwater-irrigated crops in 11 southwestern Oklahoma counties are presented. Such estimates of resource requirements, costs and returns provide decision makers with data to allocate efficiently the limited water supply to alternative crops. Seeding rates, fertilization and irrigation levels, crop yields, tillage practices, and custom rates were obtained by interviews with agricultural personnel. Prices were obtained from published sources and retailers. Irrigable soils were divided as loam, clay and sand, then subdivided by productivity level. Of the 769,629 irrigable acres, 202,800 acres were irrigated in 1967 of which 120,140 acres were irrigated by groundwater. Three irrigation levels were considered. Production values of each budget list yield per acre, price per yield unit, and product gross value. Total specified costs include non-labor variable production costs. Costs and return estimates for owner operators may be reduced to tenant operating under a leasing arrangement. Seventy tables present economic data on irrigated production. (Popkin-Arizona)
W71-04294

WATER AND CULTURE: NEW DECISION RULES FOR OLD INSTITUTIONS,
Arizona Univ., Tucson. Bureau of Ethnic Research.
For primary bibliographic entry see Field 06E.
W71-04296

THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFaSCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
Hebrew Univ., Jerusalem (Israel).
A. S. Shulov.
Anti-Locust Bulletin 48, 1970. 22 p, 21 fig, 12 re

Descriptors: *Insect eggs, *Embryonic gro stage, *Incubation, *Humidity, *Dry *Hatching, *Soil moisture, Water utilization, sects, Moisture, Inhibition, Eggs, Growth sta Sands, Moisture availability, Laboratory tests.
Identifiers: *Red Locust, *Africa, *African mig tory locust.

The development of embryos of the Red Loc and the African Migratory Locust, investigated several experiments, was found to be arrested conditions associated with absence of availa moisture. Eggs could not obtain moisture fr water vapor even in a saturated atmosphere. It w necessary for soil moisture to come in contact w the eggs in order to be absorbed. Eggs incubated moist sand developed to hatching without intern tion. Embryos in eggs subjected to deposition in sand exhibited arrested development until ag placed in moist sand. Hatching hoppers from arrested eggs were smaller than those from non-rested eggs. There were no significant differenc between the two species studied. These studies dicate that moisture availability is an important f tor in controlling locust populations. (Yense Arizona)
W71-04297

ENVIRONMENTAL CONTROL OF COLOR TION IN AN ACRIDID, GASTRIMARGU AFRICANUS (SAUSSURE),
Makerere Univ., Coll., Kampala (Uganda). De of Zoology.
C. H. Fraser Rowell.
Anti-Locust Bulletin 47, 1970, p 1-48. 27 fig, color plates, 70 ref. Makerere College Resear Fund. Grant 259.

Descriptors: *Insects, *Color, *Pigments, *H midity, *Microenvironment, Growth stages, Inhib tion, Biological properties, Drying, Arid land Xerophilic animals, Environmental effects, Lig intensity, Animal populations, Insect control.
Identifiers: *Locusts, *Africa.

Gastrimargus africanus is one of the desert locus of arid Africa, causing severe crop damage when the gregarious stage. The brown forms are gregar ous, migratory, and devastating to crops, while th green forms are solitary, less damaging, and no migratory. Locusts kept in jars with differe background colors changed color to resemble background colors except green. Those placed jars having green backgrounds did not chang color. When the eyes were covered with opaqu laquer, only very slight color changes occurred. was found that by varying humidity and numbers individuals kept together, the appearance of th green-form adult was slightly inhibited by crowdin and drying. The green form was much increased b high humidity, and high humidity with infra-re radiation. Under high humidity adult male produced were 100% green forms. Female nymph at low humidity produced no green forms. Crowd ing and high humidity both caused cumulative e fects of heavy patterning. These findings have pos tive implications for insect control in arid Africa croplands. Eleven color plates illustrate the colo forms. (Yensen-Arizona)
W71-04302

INFLUENCE OF MANAGEMENT AND EN VIRONMENTAL FACTORS ON EXTENT O SOIL WATER DEPLETION BY SPRING WHEAT,
North Dakota State Univ., Fargo. Dept. of Soils.
Armand Bauer, and Ralph A. Young.
North Dakota Agricultural Experiment Station Research Report 23, January 1969. 13 p, 1 tab, fig, 11 ref.

Descriptors: *Water management (Applied), *En vironmental effects, *Soil water, *Water loss *Wheat, Spring, Period of growth, Drainage ef fects, Fertility, Fallowing, Rainfall, Wilting point Moisture availability, Moisture content, Moisture

, Moisture deficit, Soil-water-plant relation-
Storage capacity, Soil texture, Evapotrans-
n, Soil environment, Water requirements,
mptive use, Water storage, Water distribu-
Applied), Water demand, Harvesting, Saline
Cultivation, North Dakota, Semiarid cli-

ater depletion by crops is an important
of water management in arid and semi-arid
Water-depletion trials were conducted on
o moderately-drained soils, medium-to fine-
d, under fallow and non-fallow management
ility levels from 1958 to 1962 in North
. Spring wheat withdraws water to at least 5
om soils without root restrictions. Water is
ed at harvest from soil to 3 feet. Available
emains deeper than 3 feet, if present at seed-
il fertility has little effect on depth of water
awal. Soil moisture is reduced to less than
rmanent-wilting point up to 3-foot depths
some conditions. Available water at seeding
s at harvest sites at greater than 3 feet when
g-season rainfall exceeds 10 inches, or
soil at seeding contains more than 6 inches
r. Water-depletion extent by spring wheat is
ne for poor- and well-drained, non-saline and
-saline, or non-fallowed and fallowed soils.
graphs and a table show effects of soil
ge, growing-season rainfall, stored available
oisture, and salinity on water-depletion ex-
Popkin-Arizona)
4303

UATION OF IRRIGATION WATER AND
OGEN FERTILIZER IN CORN PRODUC-

do State Univ., Fort Collins. Dept. of
mics; and Colorado State Univ., Fort Collins.
f Agronomy.
. Huszar, Melvin D. Skold, and R. E.
son.
rted by Bureau of Reclamation. Colorado
University Experiment Station, Technical
n 107, January 1970. 38 p, 7 fig, 24 tab, 29
ons, 6 computer programs, 3 ref.

ptors: *Evaluation, *Irrigation water,
gen, *Fertilizers, *Corn (Field), Crop
tion, Analytical techniques, Economic pre-
, Return (Monetary), Resource allocation,
esponse, Statistical models, Water demand,
management, Computer programs, Grains
), Forages, Input-output analysis, Water
vation, Planting management, Equations,
data collections, Regression analysis.
iers: Fortran, Partial differential equations,
rid lands.

udy empirically establishes corn production
ns for various applications of water and
n fertilizer. This analysis provides data for
ting economic returns and efficient
es allocation. A 5 X 5 incomplete factorial
generated basic yield response involving
and nitrogen fertilizer variables and corn
tion. Statistical data treatment produced
nal relations, shown as estimated water-de-
curves, which serve to guide management
ns in arid and semiarid lands. Generated
ns for various soils would be beneficial. Six
RAN computer programs are presented for
ting corns grains and forage yields for
ed water and fertilizer applications and re-
unctions. There are 24 tables of economic
and output data, statistically-developed
, and derivations of relevant partial dif-
al equations. (Popkin-Arizona)
4304

AMATION IN THE UNITED STATES,
nia State. Dept. of Water Resources, Sacra-

mary bibliographic entry see Field 06C.
4306

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
Los Angeles Bureau of Engineering, Calif.
For primary bibliographic entry see Field 08A.
W71-03906

CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
For primary bibliographic entry see Field 02E.
W71-03976

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03977

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
Dum Dum Airport, Calcutta (India); and Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03978

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
Electricite de France, Chatou. Centre de Recherches et d'Essais.
For primary bibliographic entry see Field 02E.
W71-03979

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
Transdanubian Water Authority, Szekesehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02A.
W71-03980

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
Grenoble Univ. (France).
For primary bibliographic entry see Field 02A.
W71-03983

ANALYSIS OF FLOOD DURATION (FRENCH),
Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02E.
W71-03984

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
National Office of Irrigation, Rabat (Morocco).
For primary bibliographic entry see Field 02E.
W71-03985

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
Vsesoyuznyi Nauchno—Issledovatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR); and Khabarovsk Inst. of Railway Engineers (USSR).
For primary bibliographic entry see Field 02A.
W71-03988

DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
Guelph Univ. (Ontario). School of Agricultural Engineering; and Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.
For primary bibliographic entry see Field 02E.
W71-03989

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
Consejo Superior di Investigaciones Cientificas, Madrid (Spain). Instituto de Hidrologia.
For primary bibliographic entry see Field 02E.
W71-03990

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02A.
W71-03991

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
Zakavkazskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Tiflis (USSR).
For primary bibliographic entry see Field 02E.
W71-03992

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-03995

INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Loyal A. Johnson.
Available from NTIS as AD-712 427, $3.00 in paper copy, $0.95 in microfiche. Project Report No 18, Jan 1950. 87 p, 9 fig, 52 ref. Army Contract W-21-018-ENG-430.
Identifiers: *Construction, Arctic regions, *Arctic regions, Landing fields, *Landing fields, Drainage, Roads, Freezing, Ice, Rivers, Terrain, Military facilities, Atmospheric precipitation, Erosion, Melting, Avalanches, Hydrology, Thermal properties, Alaska, Photographs, Watersheds, Surface water runoff.

This report summarizes observations that were made during a field trip to Alaska in the spring of 1949. Principal objectives of this phase of the Arctic and Subarctic Airfield Drainage Investigation were (1) to make supplemental on-the-ground observations over a wide range of hydrological phenomena, (2) to note the various forms and effects of icing, (3) to observe springtime runoff from natural watersheds, and (4) to crystallize the findings of activity completed at this time into definite recommendations and point out various aspects where continuation and even expansion of research and study are essential.
W71-04002

MOLE DRAINAGE,
Arctic Construction and Frost Effects Lab., Boston, Mass.
For primary bibliographic entry see Field 08A.
W71-04008

DRAINAGE LINE DEPTH,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08D.
W71-04016

APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
Water Resources Bulletin, Vol 6, No 5, p 713-724, September-October 1970. 12 p, 1 fig, 5 tab, 11 ref.

Descriptors: *Optimization, *Multiple-purpose reservoirs, Dynamic programming, Mathematical models.
Identifiers: *Nonlinear programming, Conjugate gradient, Gradient projection algorithm, Quasilinearization.

The recent versions of nonlinear programming techniques such as the conjugate gradient and gradient projection algorithms were used to obtain optimal operating conditions of a multiple reservoirs system with multiple purposes. The algorithms were compared with other techniques in the literature. The conjugate gradient method incorporated the advantage of both the generalized Newton-Raphson, also known as the quasilinearization technique, and the gradient approach while avoiding their major drawbacks. To illustrate the approach a model with three interconnecting reservoirs was considered and was shown schematically. The water was being used for two purposes: irrigation and recreation. The model formulated was dynamic in nature and the seasonal variation of the model was emphasized. A tabular objective function was solved by the two algorithms using several different sets of initial values. The total number of iterations required by the two different algorithms were compared. All the problems converged to the same optimum point. (Kriss-Cornell)
W71-04030

PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.

N.d., 161 p, 48 fig, 11 tab, 12 ref.

Descriptors: *Systems analysis, *Reservoir operation, *Operations research, Project planning, Reservoir sites, United States.

The purpose of this seminar was: to provide statements of specific problems in reservoir systems analysis that face the Corps of Engineers; to describe the solution techniques that are currently implemented; and to discuss the potential development of the technology, particularly the applicability of operations research techniques. The specific studies presented included problems dealing with the Kansas River Basin reservoirs, the Kaskaskia River reservoir system, the Apalachicola River, the Roanoke River, the San Francisco reservoir system, the Northeast water supply, the Columbia Basin projects, the Minnesota River Basin, the Arkansas-White-Red Rivers reservoir system, and the Missouri River Main Stem reservoir system. The cast histories and descriptions of problems presented were considered to be representative of the reservoir system problems that exist throughout the country and of the way various projects are being planned and operated. Administrative problems, personality problems and engineering problems were mentioned throughout the seminar. Present methods and future improvements were two of the main topics included in the presentations. (Kriss-Cornell)
W71-04034

AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
Water Resources Engineers, Inc, Walnut Creek, Calif.
G. K. Young.
Proceedings of the 8th Annual Environmental and Water Resources Engineering Conference, Vanderbilt University, Nashville, Tennessee, June 5-6, 1969, Technical Report no 20, p 87-98. 12 p, 3 fig, 8 ref.

Descriptors: *Dynamic programming, *Optimization, *Power system operations, *Reservoir operations, Economics, Computer programs, Hydroelectric power, Costs, Time, Hydrology.

A forward-looking dynamic program was presented which solved water resource system water allocation over time among systems elements. The computations proceeded forward in time, manipulating economic information, then backtracked through intermediate results to derive optimal physical data. The economic functions were constructed so that dollar values were estimated for every possible distribution of water throughout the system elements. Computer time and memory requirements were given. A hypothetical power optimization was discussed to show the type of problem which was amenable to dynamic programming analysis. Daily flows could be studied over a year's time for a self-contained hydropower system which occasionally purchased outside power to satisfy contractual demands. The approach could be used to identify the costs of constraints. Multiple solutions and the use of penalty functions were suggested means of implementation. Operating rules were inferred by taking the results of dynamic programming calculations, which were optimal system state values over time, and merging the data with given hydrologic data. This data set had hydrologic inflows and other side information matched, time period by time period, with optimal inter-system reservoir releases and transfers. An inference step could be implemented using least squares regression to give the decision rules with reservoir releases as dependent and hydrologic variables as independent variables. (Kriss-Cornell)
W71-04037

1969 RESERVOIR LAND USE SURVEYS: FIELD REPORT AND PROCEDURAL MANUAL,
North Carolina Univ., Chapel Hill. Inst. for Research in Social Science.
Raymond J. Burby.
Research Memorandum, Oct 31, 1969. 10 p, 2 fig, mimeo. OWRR Project B-012-NC (3).

Descriptors: *Reservoir sites, *Land use, *Surveys, *Data collections, Model studies, Aerial photography, Mapping.
Identifiers: *Data coding, Field data.

The procedures utilized to gather land use data in the field, process the data for coding, and coding the data for use in a model developed by the Center for Urban and Regional Studies for reservoir land in various forms of urban and recreational use were described. The three reservoir areas used were Lake Norman in the Charlotte Metropolitan Area,North Carolina; Lake Sidney Lanier in the Atlanta Metropolitan Area; and Lake Boone in the Tri-Cities Metropolitan Area, operated by the TVA. The criteria for recording the extent of land in an urban or recreational use varied with the type of use, i.e., either residential, commercial and industrial, public and institutional, and recreational uses. For field maps of the areas surveyed, aerial photographs and acetate overlays were used. Composite base maps were developed for use in displays and for computing and coding independent variables involving distance measures. A land use classification system was developed to recognize two basic types of land use in reservoir areas: recreation-oriented uses and employment (or urban)-oriented use. The dependent land use data was intended for use in two types of reservoir development forecast models: (1) a reservoir model and (2) a shoreline model. (Kriss-Cornell)
W71-04039

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
In: Modeling and Optimization of Water Resources Systems, Phase I, Kansas State Univ, Appendix (1970). 15 p, 15 fig, 4 ref.

Descriptors: *Optimization, *Simulation analysis, *Multiple-purpose reservoir, Water resources, Dynamic programming, Stochastic processes, Costs, Model studies.
Identifiers: *Nonlinear programming.

In order to test techniques such as simulation, queueing theory, linear and nonlinear programming techniques, and dynamic programming and also to develop more powerful optimization techniques particularly suited for large water resources systems, a water resources model which included all the important characteristics of a complex large water resources system was developed. This model was a multiple reservoir and multipurpose model. Three different optimization models, namely steady state, dynamic, and stochastic models were presented. A hypothetical reservoir system with four reservoirs and the major tributary systems was used to construct the model. The reservoir was used for five purposes: (1) irrigation, (2) municipal and industrial water supply, (3) hydroelectric power generation, (4) recreation, and (5) flood control. In order to solve the optimization problem, expressions for the various costs and revenues were obtained. Data used to establish the model were from the Jordon Creek area of the Delaware River Basin, the Clearwater River Basin in Idaho and especially the simulation model established by Maass, et al. (See also W71-04043) (Kriss-Cornell)
W71-04044

OPTIMUM OPERATION OF MULTIPURPOSE RESERVOIRS WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
In: Modeling and Optimization of Water Resources Systems Phase I, Kansas State Univ, Appendix I (1970). 20 p, 5 tab, 1 fig, 11 ref.

Descriptors: *Optimization, *Multiple-purpose reservoirs, Dynamic programming, Mathematical models.
Identifiers: Nonlinear programming, Conjugate gradient, Gradient projection algorithm, Quasilinearization.

The recent versions of nonlinear programming techniques such as the conjugate gradient and the gradient projection algorithms were used to obtain the optimal operating conditions of a multiple reservoir system with multiple purposes. These algorithms were compared with other techniques used by various researchers. The conjugate gradient method incorporated the advantages of both the generalized Newton-Raphson, also known as the quasilinearization technique, and the gradient approach while avoiding their major drawbacks. To illustrate the approach a model with three interconnecting reservoirs was considered and was shown schematically. The water was being used for two purposes: irrigation and recreation. The model formulated was dynamic in nature and the seasonal variation of the model was emphasized. A tabular objective function was solved by the two algorithms using several different sets of initial values. The total number of iterations required by the two different algorithms were compared. All the problems converged to the same optimum point. (See also W71-04043) (Kriss-Cornell)

)4046

DELAWARE RIVER BASIN COMPACT--
ALTERNATIVE FOR IMPLEMENTING
ER RESOURCES MANAGEMENT (OR-
ZATION, OPERATION, AND RESULTS
IE BASIN COMPACT),
mary bibliographic entry see Field 06E.
4089

PROPOSED POTOMAC RIVER BASIN
PACT,
mary bibliographic entry see Field 06E.
4090

WARE RIVER BASIN COMPACT.
mary bibliographic entry see Field 06E.
4093

MUM FIRE POWER OUTPUT FROM A
RESERVOIR SYSTEM BY INCREMEN-
YNAMIC PROGRAMMING,
nia Univ., Los Angeles. School of Engineer-
l Applied Science.
n A. Hall, Ricardo C. Harboe, William W. G.
nd Arthur J. Askew.
nia University Water Resources Center
bution No 130, October 1969. 65 p, 5 fig, 20
ef, 4 append. OWRR Proj B-061-CAL (1).

ptors: *Reservoir operation, *Water
ement (Applied), *Optimization, *Dynamic
mming, *Computer programs, Probability,
ogic budget, Mathematical models, Simula-
alysis, Water utilization, Water policy.
iers: Power output optimization.

del is developed for maximizing the firm
output from a two-reservoir water resources
, with firm water, flood control and the
s for noncommensurate objectives as
eters. State incremental dynamic pro-
ing is used as a tool to obtain the optimal
ng policy for a given hydrology. In this stu-
hydrology used was that defined by the criti-
iod. (See also W70-03836 and W70-05571)
)-USGS)
4111

LOPE-FREQUENCY RELATIONS FOR
MUM FLOODS IN MONSOON AREAS OF
CAFE REGION.
mic Commission for Asia and the Far East
New York.
mary bibliographic entry see Field 02B.
4117

D PLAIN INFORMATION, KIRBY
K, GRAND PRAIRIE, TEXAS.
Engineer District, Fort Worth, Tex.

of Engineers Flood Plain Report, November
1 p, 5 plate.

ptors: *Floods, *Flood damage, *Flood
*Texas, Flood control, Flood forecasting,
al flood, Design flood.

ng along Kirby Creek in Texas from the Tar-
allas County line to its mouth is described to
solving local flood problems and in planning
st utilization of flood-prone lands. Maps,
s, cross sections, and test material relating
ent of past flooding to floods which might
n the future are based on available records
fall, runoff, historical flood heights and other
al data. Unit Hydrograph coefficients have
stimated from runoff studies conducted for
watersheds within the Dallas-Fort Worth
These coefficients, together with rainfall data
een used to compute synthetic runoff hydro-
within the area. The estimated Intermediate
al Flood and Standard Project Flood
rges at Corn Valley Road are 4,900 and
cfs, respectively. (Woodard-USGS)

W71-04143

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
Corps of Engineers, Sacramento, Calif.

Corps of Engineers Flood Plain Report, October 1970. 63 p, 36 fig, 22 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Nevada, Regional flood, Flood forecasting, Flood control, Historic flood, Statistical methods.
Identifiers: *Truckee River (Nevada), Standard Project Flood, Intermediate Regional Flood.

Flooding along the Truckee River and several of its tributaries in the Reno-Sparks-Truckee Meadows area, Washoe County, Nevada is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The largest flood of record on the Truckee River in the study area occurred on 23 December 1955 with a peak flow of 20,800 cubic feet per second at Reno. That flood caused extensive damage in downtown Reno and in Truckee Meadows. An Intermediate Regional Flood on the Truckee River is one that would have a frequency of occurrence of once in 100 years on the average. Its magnitude was determined from an analysis of streamflow records and computed hydrographs of synthetic floods. These studies show that the peak flow of the Intermediate Regional Flood would be about 18,000 cubic feet per second in Reno. A Standard Project Flood on any of the tributaries in the study area would have peak flows about 20% to 50% larger than the Intermediate Regional Flood. (Woodard-USGS)
W71-04144

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
Corps of Engineers, Sacramento, Calif.

Corps of Engineers Flood Plain Report, November 1970. 31 p, 9 fig, 11 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Utah Regional flood, Flood forecasting, Flood control, Statistical methods.
Identifiers: *Burch Creek (Ogden, Utah), Standard project flood, Intermediate regional flood.

Flooding along Burch Creek in the vicinity of Ogden, South Ogden, and Riverdale, Weber County, Utah is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Records of floodflows on Burch Creek are non-existent and there are no precipitation stations in the basin. Therefore, basic hydrologic and meteorologic data were developed from records of other stream basins having characteristics similar to those of the Burch Creek basin. These studies show that an Intermediate Regional Flood on Burch Creek would have a peak flow of 1,200 cubic feet per second below Harrison Boulevard and a peak flow of 380 cubic feet per second below Washington Boulevard. A Standard Project Flood would have a peak flow of 1,480 cubic feet per second below Harrison Boulevard and a peak flow of 450 cubic feet per second below Washington Boulevard. (Woodard-USGS)
W71-04145

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
Japan Meteorological Agency, Tokyo. Forecast Section.
For primary bibliographic entry see Field 02E.

W71-04159

THE LOCATION OF LAND USE TYPES: THE NILE VALLEY IN NORTHERN SUDAN,
California Univ., Davis. Dept. of Geography.
David R. Lee.
*Economic Georgraphy, Vol 46, No 1, p 53-62, January 1970. 4 fig, 15 ref.

Descriptors: *Crop production, *Land use, *Regional analysis, *Irrigation systems, *River basins, Economic justification, Social impact, Environmental effects, Rainfall, Floodwater, Flood plains, Flood irrigation, Land resources, Land management, Arid lands, Transportation, Capital, Social values, Social aspects, Dates, Wheat, Pumping, Irrigation practices, Horticulture, Deserts.
Identifiers: *Sudan, *Nile River, *Nomadism, Millet.

A regional land use study was made in the northern Sudan covering a reach of the Nile River from the Sixth Cataract to the village of Abu Hamed, where the Nile begins its great bend southward. Within the study region, 7 types of land utilization were recognized. (1) Settlements-including 600 small villages, primarily local trading centers and 4 larger towns with administrative as well as commercial importance. (2) Horticulture-located mainly in the more southerly regions and consisting mainly of small units growing cash crops for urban markets; irrigation water is lifted from the Nile by counterweighted dipper Persian waterwheel or small, diesel-driven pumps. (3) Major pump schemes-consisting of fairly large pump scheme tenant holdings growing cash crops. (4) Flush cultivation of dura millet with irrigation waters from the Nile during flood stage-a one crop per year agriculture sold locally. (5) Dates and Wheat-the wheat is sown in wet Nile silt after the flood and consumed locally while the date palms are grown on riverbanks and the dates are both consumed locally and sold commercially. (6) Rain cultivation of dura-the only water supply is rainwater and the Nile farmer are discontinuing this practice although it is still the method of grain production throughout the Sudan. (7) Grazed or unused desert-primarily pastoral nomadism. Land is utilized in a particular way throughout this region because of a complex interaction of factors--physical, economic and cultural. (Casey-Arizona)
W71-04228

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN: ORGANIZATION AND MANAGEMENT,
Leeds Univ. (England). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-04231

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
California State Div. of Forestry, Sacramento.
L. T. Burcham.
Association of American Geographers, Proceedings, Vol 2, p 36-39, 1970. 1 tab, 2 ref.

Descriptors: *California, *Grasslands, *Ecology, *Biological communities, *Water utilization, Grasses, Plant populations, Environmental effects, Mode of operation, Seeds, Germination, Grazing, Agriculture, Habitats, Soil moisture, Productivity, Plant groupings, Nutrients, Geographical regions, Annual succession, Succession vegetation establishment.
Identifiers: *Annual plants, *Perennial plants, *Adaptability, *Alien plants.

Approximately 12 million acres of California now under cultivation or occupied by urban or industrial areas, were originally predominate grasslands. Those remaining grassland areas are generally subjected to intensive grazing and have undergone major alterations. Most striking is the almost complete replacement of native perennial grasses by alien, Mediterranean-type annual plants. This

has occurred in the past century, largely by unintentional seed introduction, and has been characterized by 4 stages of plant succession, the last of which is well established. Mediterranean-type plants are highly adaptive to a wide range of ecological conditions. The significant adaptations facilitating their establishment in California are their ability to grow well under conditions of low temperatures and high soil moisture; quick, effective germination in response to sporadic rains; rapid growth and early maturity; and prolific production of viable seeds. The chronological sequence of dominance corresponds to the descending scale of annual plant succession, indicating a decline in productivity. Further, those plants lower on the annual succession scale germinate faster than those higher up. Conditions for alien grass establishment are usually brought on by overgrazing. Productivity lowering is a decline both in nutrient levels and palatibility. The changes in plant composition have resulted in ecologically significant shifts in biotic relationships of the plant-animal complex. (Casey-Arizona)
W71-04233

HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
For primary bibliographic entry see Field 06E.
W71-04246

FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Earl F. Aldon.
US Forest Serv Res Note RM-173, 1970. 2 p.

Descriptors: *Ranges, Carrying capacity, Land management, *Vegetation establishment, Productivity, *Forages, *Flood plains, *Erosion control, *Soil stability, New Mexico.
Identifiers: Forage production, Ground cover.

Fourwing saltbush, Atriplex canescens (Pursh) Nutt., survived well and grew more than 1 foot during the first year when native seed was grown to 4- to 6-week-old transplants, then transferred to low sites that received some flooding before planting. (Aldon-Forest Service)
W71-04247

WATERSHED MANAGEMENT IN THE UNITED STATES: CONCEPTS AND PRINCIPLES,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W71-04253

LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
M. Frankel.
1969. 196 p.

Descriptors: *Massachusetts, *Public rights, *Watercourses (Legal), *Maine, Seashores, Legislation, Governments, Ownership of beds, Legal aspects, Ponds, Rivers, Oceans, Shores, Fishing, Fisheries, Relative rights, Riparian rights, Tidal waters, History, New England, Docks, Boundaries (Property), Estuaries, Bays, Navigation, Navigable waters.

Maine and Massachusetts water law derives from the English common law as modified by the United States Constitution, the colonial ordinances, and subsequent statutes. After discussion of the origin and history of Massachusetts water law, extensive treatment is given property rights in watercourses and the rules governing settlement of boundary disagreements and determination of title to flats and accretions. Navigability of waterways and the legal rights and restrictions resulting from a finding of navigability are explored. The latter portion of the work is devoted to conflicts between state, federal, municipal and private use and control of activities involving watercourses and adjacent property. State regulation predominates, but is restricted by the common law and colonial ordinances. Public and private rights of fishing are discussed in relation to each of the other topics covered. (Dye-Florida)
W71-04257

DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle.
USDA Forest Service Research Note INT-108, 1970. 7 p, illus.

Descriptors: *Peak discharge, *Flood protection, *Flood control, *Small watersheds, *Contour furrows, Contours, Terracing, Infiltration, Ponding, Seepage, Soil engineering, Percolation, Storm runoff, Erosion control, Hydrographs, Rainfall-runoff relationships, Precipitation intensity, Frozen soils, Depression storage, Utah.
Identifiers: *Contour trenches, *Wet-mantle floods, *Sierra Nevada.

A description is given of the January-February flood and associated events that took place on the east side of the Sierra Nevada in 1963, especially those occurrences recorded and observed in a small watershed in the flood-sourc area. Some 110 lineal miles of contour trenches in this 16-square mile watershed may have reduced flow during that flood by about 60 acre feet. (DeByle-Forest Service)
W71-04262

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle.
USDA Forest Service Research Note INT-115, 1970. 5 p.

Descriptors: *Contour furrows, *Contours, *Terracing, *Infiltration, *Infiltrometers, Ponding, Seepage, Soil texture, Soil engineering, Hydrologic properties, Percolation, Overland flow, Storm runoff, Erosion control, Flash floods, Floods, Utah.
Identifiers: *Contour trenches, *Double-ring infiltrometers.

Infiltration rates for water ponded in the bottoms of contour trenches constructed in the Sierra Nevada were determined by means of double-ring infiltrometers. The average rate in coarse-textured soils derived from granite was 19.5 inches per hour, more than six times the 3-inch-per-hour rate measured in fine-textured soils derived from andesite. These widely differing rates should be considered when designing a trench network. The probable influence of contrasting infiltration rates on water yields is discussed. (DeByle-Forest Service)
W71-04263

ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
Tennessee Univ., Knoxville. School of Engineering.
Glenn R. Wall.
M. S. Thesis, University of Tennessee, Distributed by Tennessee Valley Authority, December, 1969. 151 p, 12 fig, 6 tab, 134 ref, 4 append.

Descriptors: *Flood protection, *Flood plain zoning, Decision-making, Methodology, *Tennessee Valley Authority project.
Identifiers: Maximum Probable Flood, Maximum Known Flood, Regional Flood.

Although land use controls are a necessary instrument in flood control planning, the author suggests that engineering information is required in orde substantiate the need for such controls as well a aid community leaders in decision-making. Aft careful analysis of legal cases dealing with the plication of land use regulations to the flood pl the author concludes that these regulations a legal exercise of the police power. The author lines a nine step procedure for evaluating the al native flood control measures, considering criteria as economics, hydrology, meteorol agronomy. (Holmes-Rutgers)
W71-04270

USING COMPUTERS TO HELP EVALUA FLOOD PROTECTION MEASURES,
Economic Research Service, Washington, D Natural Resource Economics Div.; and Oklaho State Univ. Stillwater. Dept. of Agricult Economics.
For primary bibliographic entry see Field 07C.
W71-04293

PUBLIC WATER POLICY IN TENNESSEE.
Public Administration Service, Chicago, Ill.
For primary bibliographic entry see Field 06E.
W71-04308

4B. Groundwater Management

OPTIMUM UTILIZATION AND MANAG MENT OF WATER BEARING FORMATIO HYDRAULICALLY CONNECTED TO STRETCH OF THE CONNECTICUT RIVER,
Mass Univ., Amherst. Water Resources Resea Center.
Ward S. Motts.
Available from NTIS as PB-197 118, $3.00 paper copy, $0.95 in microfiche. Project Comp tion Report, Massachusetts Water Resour Research Center, Amherst, December, 1970. 2 11 ref. OWRR Project A-021-MASS (1).

Descriptors: *Aquifers, Hydrogeology, Grou water, *Induced infiltration, *Artificial rechar Recharge, *Groundwater recharge, Subsurfa waters, Infiltration, Urbanization, Massachuse Conjunctive use.

This investigation examined the groundwa resources and groundwater-recharge potential the Greater Springfield Complex--a high-den urban area surrounded by a rural peripheral a that will soon undergo urban development. Hig productive gravel and sand aquifers of glacial o wash underlie parts of the peripheral areas, es cially west of East Mountain and in the towns Granby, Hampden and Wilbraham, Mass. Also buried channel of outwash yields copious grou water supplies which are used by the municipal of South Hadley. This buried channel overlain poorly permeable silt and clay may contain la undeveloped supplies of groundwater in the So Hadley and South Springfield areas. Potential tificial recharge sites occur along areas of glac outwash in the Greater Springfield Complex. P grams could be developed to recharge surfa water into the aquifers during winter and spr and withdraw the groundwater during the hea water demand periods of summer and f Recharge to wells by induced infiltration is possi along some of the tributaries to the Connecti River such as the Chicopee River, Scantic Riv and Great Brook.
W71-03919

AVAILABILITY OF GROUNDWATER WESTERN COWLITZ COUNTY, WASHIN TON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02F.
W71-03934

)UNDWATER RESOURCES OF COLLING-)RTH COUNTY, TEXAS,
ogical Survey, Austin, Tex.
rimary bibliographic entry see Field 02F.
-03935

LOGY AND GROUNDWATER DURCES OF ALLEN COUNTY, KANSAS,
as State Geological Survey, Lawrence.
rimary bibliographic entry see Field 02F.
-03937

UNDWATER STORAGE CONTROL ER INSTITUTIONAL RESTRICTIONS,
ana State Univ., Bozeman.
r R. Burt.
r Resources Research, Vol 6, No 6, p 1540-, December 1970. 9 p, 1 fig, 11 ref.

riptors: *Optimization, *Mathematical ls, *Groundwater, Time, Natural recharge, ıg, Economic efficiency, Institutional con-ts.

nal allocation of groundwater over time was zed for situations in which institutional con-ts prevent imposition of a criterion based y on economic efficiency. First, an un-cted optimization of groundwater stocks to nize present value of production. Natural rge was a random variable that complicated ecision process. Then, pricing by a central y under a criterion of economic efficiency hown to be a theoretically sound approach technically feasible one. Next, rationing by other than price was dealth with. Water expressed as a function of a conditional deci-ule X (s) was said to be the best alternative to ct pricing policy. In defining the temporal al-on model, the length of the discrete time d was left undefined, yet a period of one year ltiples of years was assumed. Another model on compromise rationing by the central y dealt with actual physical apportionment. inal model for simplified basin control was a and-for-all decision model where the only on variable was the time in the future at the basin is rationed to use only net periodic rge, and until that time groundwater use is un-olled. This situation would arise in absence of tral control agency. (Kriss-Cornell)
04024

MAL OPERATION OF WATER SUPPLY EMS,
na Univ., Tucson. Hydrology and Water ırces.
ge Samuel Clausen.
nical Report No 1, June 1970. 142 p, 23 fig, b, 53 ref. OWRR Projects A-010-ARIZ (19) -007-ARIZ (5).

riptors: *Optimization, *Water supply, hematical models, *Economics, Costs ndwater, Demand, Arizona.
ifiers: Tucson Basin.

raditional water-supply planning problem of omic growth was reviewed in terms of con-of management science. The various water-y planning objective functions were all ex-ons which maximized the difference between and losses involved with water development. mization was performed using quadratic pro-ming, Lagrangian multiples, and calculus. An tive function used to express the water supply em in the Tucson Basin, considered gains as revenue to a hypothetical central water-con-gency which sells water to the uses within the The concept of economic demand was used imate the amount of water that municipal, in-al, and agricultural users would purchase at ent prices. Linear demand functions were for-ed. The possible sources of supply considered groundwater from within the basin, ground-from the neighboring Avra Valley Basin, reclaimed waste water and Central Arizona Project water from the Colorado River. Constraints were formulated to allow for limits on water availability for social limits on water prices and for minimal requirements of each user over a specified time period. (Kriss-Cornell)
W71-04042

WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
Kansas State Coll. of Pittsburg. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-04065

GLOSSARY OF TERMS USED IN WELL LOGGING,
Chevron Oil Co., Houston, Tex.
For primary bibliographic entry see Field 10.
W71-04113

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 05C.
W71-04116

MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 05B.
W71-04121

THE PUMPED WELL,
Colorado Agricultural Experiment Station, Fort Collins.
Robert E. Glover.
Colorado State University Experiment Station, Technical Bulletin 100, September 1968. 23 p, 6 fig, 11 ref.

Descriptors: *Wells, *Pumping, *Water conservation, *Groundwater, *Water management (Applied), Well spacing, Estimating, Evaluation, Withdrawal, Irrigated land, Electric power demand, Water requirements, Water table, Surface-groundwater relationships, Safe yield, Stability, Water supply, Recharge, Storage capacity, Water balance, Transmissivity, Percolation, Drawdown, Consumptive use, Crop production, Precipitation (Atmospheric), Seasonal, Irrigation water, Colorado, Equations.
Identifiers: *Stream depletion, *Intermittent pumping, *Distributed pumping, Arkansas Valley (Colorado), South Platte Valley (Colorado), San Luis Valley (Colorado), Grand Valley (Colorado), High Plains (Colorado).

The charts presented in this bulletin provide a means of estimating the quantitative effect of existing groundwater pumpage and proposed changes in the irrigation areas of Colorado. About 175,295,349 kilowatt hours of electrical power lifted 1,750,000 acre/feet of water in 1966 in Arkansas Valley, South Platte Valley, San Luis Valley, Grand Valley and the High Plains of Colorado. Important questions are the effect of groundwater pumpage on nearby streams and water tables, safe yields, water supply stability, natural and artificial recharge, and storage capacity. Examples of calculating transmissivity, drawdown, stream depletion, intermittent - and distributed-pumping effect, seasonal variations, and sinking-water table are presented. Six graphs and enclosed sketches show drawdown, stream depletion, seasonal variation, and intermittent and distributed pumping. Effects of evaporation, transpiration, and irrigation-water recharge are discussed. Consumptive use and crop demands in terms of precipitation, irrigation supply and percolation loss are considered in order to develop a water budget. (Popkin-Arizona)
W71-04292

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-04294

4C. Effects on Water of Man's Non-Water Activities

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-03917

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 05A.
W71-03929

NATURE'S LAW AND MAN'S ETHIC,
Army Engineer District, Omaha, Nebr. Design Branch.
Jack E. Kepler.
Water Spectrum, Vol 2, No 4, p 35-42, Winter 1970.

Descriptors: *Environmental engineering, *Water resources development, *Ecology, *Multiple-purpose projects, *Optimum development plans, Economics, Fish management, Wildlife management, Recreation, Aesthetics, Habitat improvement, Environment, Revegetation, Dams, Planning, Colorado, Flood control, Wildlife habitats, Natural resources, Air pollution, Water pollution control, Ecosystems, Missouri River, Nebraska, Landscaping.
Identifiers: U. S. Army Corps of Engineers, Boulder Creek (Colorado), South Platte River Valley (Colorado).

The U. S. Army Engineer Omaha District has realized that ecological consequences of engineering works are now a major social concern. The Omaha District is working through coordination of many state and federal agencies to develop a far-reaching environmental resource program. Disciplines included in the program are: ecology, water resources development, architecture and landscaping, zoology, botany, wildlife management, economics, archaeology, urban planning, education, and aesthetics. Total use of all project areas is carefully planned, including air and water pollution control, re-vegetation and other plantings; reservoir water-level management; flood control; promoting growth of natural vegetation; maintaining and/or providing refuges and/or spawning or nesting areas; creating greenbelts; preserving historical and archaeological sites, and increasing or maintaining scenic values. Water resource planning now requires not only technical engineering competence but also an understanding of ecology and an appreciation for environmental values. (Yensen-Arizona)
W71-04069

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
Federal Water Quality Administration, Washington, D.C. Div. of Applied Science and Technology; and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04147

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
Agricultural Research Service, Washington, D.C. Sedimentation Lab.

For primary bibliographic entry see Field 04D.
W71-04148

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
Bureau of Public Roads, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04149

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
Utah Water Research Lab., Logan.
Joseph B. Evelyn, V. V. Narayana, Riley Dhruva, J. Paul, and Eugene K. Israelsen.
Available from NTIS as PB-197 452, $3.00 in paper copy, $0.95 in microfiche. Completion Report PR WG 74-1, August 1970. 51 p, 10 tab, 35 fig, 17 ref, 3 append. OWRR Project B-025-UTAH (3).

Descriptors: *Simulation analysis, Hydrologic models, *Hydrograph analysis, Watershed studies, Storm drains, *Runoff, Texas, *Model studies, Computer models, *Analog models, Computer programs, Urbanization, Flood forecasting.
Identifiers: Waller Creek, Austin (Texas), *Urban hydrology.

An analog computer program was developed to simulate the outflow hydrographs at four locations within the 38th Street Waller Creek urban watershed at Austin, Texas. Actual outflow was gaged at the final outlet of the watershed. This provided a checkpoint for comparing the simulated and observed final outflow hydrographs. The outflow hydrographs for each subzone were obtained by chronologically abstracting interception, infiltration, and depression storage from their precipitation hyetographs. These outflow hydrographs were then routed through Waller Creek channel to obtain the hydrographs at the four desired locations. The advantages of this model are the flexibility in varying the precipitation inputs to each subzone and the ability to obtain the contribution to the final flood hydrograph of each subzone.
W71-04184

4D. Watershed Protection

THE SAM SIMON WATERSHED: SHRUB CONTROL,
Arizona Univ., Tucson. Coll. of Agriculture.
For primary bibliographic entry see Field 03F.
W71-04058

WATERSHED PROJECTS.
For primary bibliographic entry see Field 06E.
W71-04104

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
Federal Water Quality Administration, Washington, D.C. Div. of Applied Science and Technology; and Geological Survey, Washington, D.C.
Allen Cywin, and Ernest L. Hendricks.
In: Proceedings of National Conference on Sediment Control, September 14-16, 1969, Washington, D C, Environmental Planning Paper, Department of Housing and Urban Development, p 34-40, May 1970. 7 p.

Descriptors: *Sedimentation, *Erosion control, *Sediment control, Water pollution, Turbidity, Sediment transport, Streams, Reservoirs, Reservoir silting, Urbanization, Roads, Construction, Air pollution, Dusts.

Objectives of the following organizations within the USDI having programs related to sediment pollution and its control are reviewed: (1) Federal Water Pollution Control Administration, (2) Geological Survey, (3) Bureau of Reclamation, (4) Bureau of Mines, (5) Bureau of Sport Fisheries and Wildlife, (6) Bureau of Outdoor Recreation, (7) Bureau of Land Management, (8) Office of Water Resources Research, and (9) National Park Service. Sediment represents a heavy economic drain in loss of valuable topsoil. It also makes water unfit for use as municipal and industrial sources of supply unless the water undergoes expensive treatment. It also interferes with navigation, destroys esthetic values and injures aquatic life. As a nutrient carrier, it promotes algal growths which degrade water quality and in turn accelerates the aging process of lakes and reservoirs. Utilization of existing techniques and development of new techniques for sediment control that are tailored specifically for use in urban or urbanizing areas are musts if adequate control of sediment problems is to be achieved and these in turn must consider ecology and water quality requirements. (See also W71-04146) (Woodard-USGS)
W71-04147

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
Agricultural Research Service, Washington, D.C. Sedimentation Lab.
A. R. Robinson.
In: Proceedings of National Conference on Sediment Control, September 14-16, 1969, Washington, D C, Environmental Planning Paper, Department of Housing and Urban Development, p 48-54, May 1970. 7 p, 4 ref.

Descriptors: *Erosion, *Sediments, *Urbanization, *Erosion control, Construction, Sediment transport, Streams, Planning.
Identifiers: *Erosion control measures.

Under urban construction activity, sediment loads of 25,000 to 140,000 tons per square mile have been measured. Erosion and sediment are usually liabilities, and specific efforts to reduce or manage the adverse effects are required for successful or satisfactory development in use of water and related land resources. Reduction of sediment problems requires information and technology on the mechanics of erosion and sedimentation. The physical and chemical properties of soils also are important factors in the control of erosion. There are needs for new knowledge and methods particularly adapted to the situation where large areas are suddenly changed to urban uses. Generally overlooked is the fact that a flowing stream is a dynamic body which has the energy to transport silt and sediment. Unless flowing in a channel that is nonerodible, such as concrete, the stream will attempt to transport sediment up to its energy ability, and may erode or degrade the bed or surface to obtain this material. If it is carrying a load greater than the available energy, then deposition will occur. Therefore it must be considered to be almost a living, viable body and treated as such. Recommended control measures are presented under the following headings: Permanent vegetation; Diversions; Outlet channels; Bench terraces; Waterway stabilization structures; Bank erosion structures; Stream channel construction; Sediment Basins; and Timing of construction. (See also W71-04146) (Woodard-USGS)
W71-04148

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
Bureau of Public Roads, Washington, D.C.
Lester A. Herr.
In: Proceedings of National Conference on Sediment Control, September 14-16, 1969, Washington, D C, Environmental Planning Paper, Department of Housing and Urban Development, p 41-47, May 1970. 7 p.

Descriptors: *Erosion, *Sediments, *Erosion control, *Construction, *Highways, Sediment transport, Streams, Planning, Design, Flood damage.
Identifiers: Highway maintenance.

This report emphasizes the importance of prudent planning in highway construction to control erosion and sediment problems that deteriorate c natural resources. Erosion and scour of the ban and beds of streams and rivers are problems be during design and construction of our highways a for years after they are built. Rivers change cou and meanders move downstream which make c bridge piers and abutments vulnerable to attack the main current. In some cases, the initial m river bridge becomes ineffective as a waterway. such a case expensive revetment or additio openings must be constructed. Channel chan made downstream from our highway structu cause degradation of streambeds which make fo dations of existing bridges unsafe and have cau failures. Suggestions for approaching these a other related problems are presented. (See a W71-04146) (Woodard-USGS)
W71-04149

THE EFFECT OF VEGETATION CONVERSI AND FLOOD DISCHARGE ON STREAM CHA NEL GEOMETRY: THE CASE OF SOUTHE CALIFORNIA WATERSHEDS,
California Univ., Los Angeles.
Antony R. Orme, and Robert G. Bailey.
Association of American Geographe Proceedings, Vol 2, p 101-106, 1970. 1 fig, 1 ref.

Descriptors: *Chaparral, *Channel flow, *Vege tion effects, *Discharge (Water), *Grassed wat ways, Watersheds (Divides), Debris avalanch Streamflow, Surface drainage, California, S moisture, Hydrologic data, On-site investigatio Root systems, Ecology, Ecosystems, Rainfall, I vironmental effects, Soil erosion, Precipitation (mospheric), Geomorphology, Oak trees, Ripar land, Sediment transport, Sycamore trees, Sk stability, Channel morphology, Canyons, Floo Sediment load, Energy losses, Storms, Mode of tion, Topography, Semiarid climates, Brush c trol, Land management, Demonstrati watersheds.
Identifiers: *Channel form ratio, *Soil slips.

The geometry of a stream channel is a product many variables. Some are independent, so semidependent and some dependent on the ch nel itself, but all relate ultimately to the broad vironmental parameters of physique, climate a biota. Study of channel geometry adjustment hydrologic fluctuations may be facilitated by spectacular environmental responses owing changing land use and management practic Monroe and Volfe canyons are neighboring, simi watersheds in the San Dimas Experimental Fore Both have 15-45 degree hillslopes which perio cally contribute choking amounts of debris to stream channels. Between 1958-1960, 74 ha. Monroe Canyon sideslopes were converted fr chapparral to grass while all of Volfe Canyon w allowed to revert naturally after a fire. Dur 1958-1963 rainfall was low and Canyon morpho gies were unchanged. By contrast, during stormier 1963-1969 period all areas suffered s slippage and erosion, but Monroe Canyon more than 8 times the debris and sediment from slopes than Volfe Canyon. The root systems of native brush are greater soil stabilizers than gr Cross-sectional surveys of canyon geomorphol established greater changes in Monroe Cany This is ascribed, at least in part, to changes in ch nel stability and stream discharge resulting fr riparian vegetation clearing. (Casey-Arizona)
W71-04230

WETTING AGENT FAILS TO CURB EROSI FROM BURNED WATERSHED,
Forest Service (USDA), Berkeley, Calif. Paci Southwest Forest and Range Experiment Station
Raymond M. Rice, and Joseph F. Osborn.
USDA Forest Serv Res Note PSW-219, 1970. 5 p

Descriptors: *Wettability, *Surfactants, *For fires, *Chaparral, *On-site tests, Soil treatme Rill erosion, Overland flow, Small watershe Prototype tests, Erosion control, Brush, Storm noff, Water quality, California.

tifiers: Southern California, January 1969
d, Waternrepellent soil.

ilot watershed test of the use of a wetting agent
ontrol post-fire erosion showed no effect due to
tment. Further studies are underway to pin-
t the cause of the failure and to develop
hods for surmounting it. (Rice-Forest Service)
-04250

WATER QUALITY MANAGEMENT AND PROTECTION

**ERSE OSMOSIS DESALTING STATE-OF-
-ART (1969).**
nan Associates, Inc., Columbia, Md.
primary bibliographic entry see Field 03A.
-04225

Identification of Pollutants

**CTROPHOTOMETRIC DETERMINATION
THIOCYANATE AND OXALATE,**
ouri Univ., Columbia. Dept. of Chemistry.
ert E. Neas.
D. Thesis, Missouri University, January 1970.
p, 25 fig, 20 tab, 54 ref. OWRR Projects B-
MO (5) and A-014-MO (6).

criptors: *Spectrophotometry, *Chemical anal-
*Analytical techniques, *Water analysis,
oratory tests, Methodology, Evaluation, Instru-
tation, Test procedures.
tifiers: *Thiocyanate, *Oxalate, Uranium.

ew indirect spectrophotometric method for the
rmination of trace quantities of oxalate utilizes
xalate interaction with uranium present as the
ium-4- (2-pyridylazo) resorcinol complex. The
tivity and selectivity of the method compares
rably with existing ones and its operational
licity is unique among methods for oxalate. A
e multicomponent reagent is combined with
ample, the absorbance measured, and the ap-
riate comparison made with standards or a
ration curve. The continuous variations curves
ined by plotting absorbance diminishment ver-
nole fraction of oxalate are evidence of the na-
of the oxalate-uranium interaction. Precise ex-
olations of the curves were possible at both the
elengths employed, yielding results of 0.47 and
mole fraction of oxalate, indicating a 1:1 oxa-
Uuranium interaction in each case.
odard-USGS)
-03928

**LITY OF RUNOFF FROM DIVERSIFIED
AN WATERSHEDS,**
ona Univ., Tucson. Dept. of Civil Engineering
Engineering Mechanics.
nu V. Dharmadhikari.
Thesis, Arizona University, 1970. 107 p, 4 fig,
b, 21 ref. OWRR Project A-012-ARIZ (1).

criptors: *Water quality, *Surface waters, *Ru-
*Hydrologic data, *Data collections,
zona, Urbanization, Chemical analysis,
hwest U. S., Chemical properties, Biological
erties, Watersheds (Basins), Water pollution
es, Water resources, Chemical oxygen de-
d.
tifiers: *Urban hydrology, Experimental
rsheds.

ity-of-water data are presented from analysis
mples collected during the summer and winter
seasons of 1969 from three different types of
rsheds in Tucson, Arizona. Continuing expan-
and intensification of urban and metropolitan
lopment in semiarid regions of the Southwest
ed States are adding to the problems as-
ated with water supply and management.
an runoff shows very high values of COD (Chemical Oxygen Demand), even more than that of the secondary sewage treatment plant effluent. In residential and commercial watersheds, this appears to be due to the suspended organic matter. Range of values in such watersheds is from 91 to 347 mg/l. The range observed in runoff from the industrial watershed is considerably higher and wider, 141 to 1693 mg/l. Tests indicate that runoff from domestic or commercial areas can be used for recreational or domestic uses after treatment with alum and adequate chlorination. (Woodard-USGS)
W71-03929

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering; and New York State Dept. of Conservation, Syracuse. Div. of Water Resources.
For primary bibliographic entry see Field 05B.
W71-03938

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04048

STRUCTURE OF WATER IN MICROEMULSIONS: ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
Florida Univ., Gainesville. Dept. of Chemical Engineering; and Florida Univ., Gainesville. Dept. of Anesthesiology.
For primary bibliographic entry see Field 01B.
W71-04108

ARSENIC IN POTABLE DESERT GROUNDWATER: AN ANALYSIS PROBLEM,
Naval Weapons Center, China Lake, Calif. Michelson Labs.; and Boron Community Services District, Calif.
For primary bibliographic entry see Field 02K.
W71-04109

COST OF PATUXENT RIVER QUALITY MONITORING,
Geological Survey, Arlington, Va.
Jon W. Nauman, and Robert L. Cory.
Journal of American Water Works Association, Vol 62, No 12, p 796-798, December 1970. 3 p, 1 tab, 2 ref.

Descriptors: *Monitoring, *Water quality, *Estuaries, *Water pollution effects, Water temperature, Dissolved oxygen, Electrical conductance, Turbidity, Tides, Water levels, Winds, Instrumentation, Costs.
Identifiers: *Patuxent River (Md).

In October 1963, the USGS installed a continuous water-quality data collection system on the Patuxent River Bridge, near Benedict, Md. The system was instrumented to provide background water quality data for correlation with spot samples taken elsewhere in the estuary and with biological studies carried on in the vicinity of the bridge. Recorded parameters included surface and bottom water temperatures, surface DO, conductivity, turbidity, tide stage, wind speed and wind direction. Total installation and maintenance costs were $22,200. Disregarding installation, the greatest cost was $16,200 or $2,700 annually, for routine maintenance, recalibration, and travel. Overall costs for the collection of water quality data averaged $5,000/yr. The cost was $625 per parameter per year, not including data interpretation and processing. (Knapp-USGS)
W71-04115

A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
Mellon Inst., Pittsburgh, Pa.; and Virginia State Water Control Board, Richmond.
Robert A. Baker, and Robert Jennings.
Water and Sewage Works, Vol 117, No 12, p 412-416, December 1970. 5 p, 5 fig, 3 tab, 16 ref.

Descriptors: *Water quality, *Taste, *Odor, *Gas chromatography, *Virginia, Analytical techniques, Organic matter, Solutes, Water pollution effects, Water treatment.
Identifiers: Smith River (Va).

Taste and odor problems in the water of the Smith River, Virginia were studied using gas-liquid chromatography. Phenol is not present in the raw water. The fine red precipitate found in these waters, including the plant mixing basin, suggests an alternate mechanism for organic contaminant transport other than as dissolved solute. The particulates may serve as condensation nuclei for organic materials. Changes in river flow rate alter the scouring velocity for critically-sized particles. These solids then carry along organic materials which in that particular volume occur at concentrations in excess of their discharge or formation rates. (Knapp-USGS)
W71-04119

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
Denver Board of Water Commissioners, Colo.
Clair G. Farnsworth.
Water and Sewage Works, Vol 117, No 12, p 418-421, December 1970. 4 p, 1 map, 2 tab, 16 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Molybdenum, *Colorado, Toxicity, Public health, Water treatment, Water quality.
Identifiers: *Denver (Colo).

Denver, Colorado uses a water supply with a molybdenum content of over 15 micrograms per liter. While molybdenum is much less toxic in general than other metals, such as arsenic, selenium, chromium, and lead, it is suggested that suitable protection should be taken to insure against any large amount of a water-soluble compound of molybdenum entering public water systems. There have been no reports of toxicity due to this molybdenum content of drinking water. Intake of molybdenum is about 0.00003% of average body weight, well within presently accepted tolerable limits. (Knapp-USGS)
W71-04120

ISOTOPE HYDROLOGY, 1970.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W71-04133

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.
For primary bibliographic entry see Field 07C.
W71-04150

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
Missouri Univ., Rolla. Dept. of Geology.
Nicholas Howard Tibbs.
M Sc Thesis, Missouri University at Rolla, 1969. 77 p, 19 fig, 1 plate, 3 tab, 38 ref, 6 append. OWRR Project B-021-MO (1).

Descriptors: *Water quality, *Water analysis, *Surface waters, *Water pollution sources, Water chemistry, *Missouri, Streams, Chemical analysis, Spectroscopy, Copper, Natural streams, Geochemistry, Data collections, Geology, Mining.

Identifiers: *New Lead Belt (Missouri), Lead, Zinc.

The New Lead Belt of southeast Missouri, predicted to be one of the largest lead deposits in the world, extends from just west of Ellington, on a due north line to Viburnum. At present this area is one of sparse population and relative wilderness, with rugged hills and swift, crystal-clear streams. It was anticipated that the lead mining activity will stimulate a sharp increase in industrial activity in the future in this area. Here then was a potential 'before-after' study in pollution. It was presumed that this intense mining activity could cause significant contamination in the stream waters by the heavy metals- notably copper, lead, and zinc, the primary ore metals. Analytical methods for these metals were developed for atomic absorption spectroscopy. The data obtained from these analyses were arranged in histograms and critically analyzed. The background concentrations were established to be 4-6 ppb (parts per billion) for all three elements. Methods are presented for identifying both short term and long term contamination by using the data distributions. The data distributions were not useful for geochemical prospecting under the geological conditions studied. (Woodard-USGS)
W71-04182

REARING DEVICES FOR STREAM INSECT LARVAE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 07B.
W71-04190

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
William T. Mason, Jr., J. B. Anderson, R. Douglas Kreis, and William C. Johnson.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R315-R328, August 1970. 6 fig, 4 tab, 7 ref.

Descriptors: *Water quality, *Bioindicators, *Municipal wastes, *Water pollution, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Return flow, Midges, Mayflies, Caddisflies, Dragonflies, Oligochaetes, Clams, Snails, Larvae, Sampling, Nutrients, Farm wastes, Water pollution effects, Path of pollutants, Oregon.
Identifiers: *Klamath River, Lost River, Damsel flies, Leeches, Beetles, Moths, Scud, Sowbugs, Flatworms, Bryozoa, Hydras, Sponges, Artificial substrates.

In 1964 the Federal Water Quality Administration (FWQA) initiated the Klamath basin study to determine the effects on water quality of agricultural wastes in irrigation return water on the Klamath and Lost Rivers. As part of the study, macroinvertebrates were collected at monthly intervals to determine the effects of irrigation return water and pollution from the city of Klamath Falls on the aquatic life. During 1965 and 1966, artificial substrates were installed at five locations in a 30 mile reach of the Klamath River, Oregon. The samples were collected on artificial substrates held in wire baskets which were suspended not more than 48 inches or less than 18 inches below the water surface. The organisms collected were divided into two categories, pollution associated and facultative. The macroinvertebrates collected at various locations and for different times of the year are enumerated in tables. In addition, the percentage of facultative and pollution associated organisms at the various sampling stations are shown. The water temperature, dissolved oxygen, and pH at the various locations is also given. The number of macroinvertebrates collected in the Klamath River during the summer of 1965 and 1966 ranged from a minimum of 44 collected in September 1965 to a maximum of 7,120 collected in July 1965. 84 taxa representing 15 orders were identified from samples collected each month at each station during 1965. The most prevalent organisms in the samples during 1965 and 1966 were those which are found in marginal zones of pollution: Chironomid larvae, oligochaetes, amphipods, isopods, odonates, leeches, and gastropods. (Little-Battelle)
W71-04191

EVALUATION REPORT 1: AUTOMATIC BEAKER SAMPLE CHANGER,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 07B.
W71-04192

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05C.
W71-04193

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. June 1970 (Repringt). 27 p, 9 fig.

Descriptors: *Sampling, *Periphyton, *Analytical techniques, *Zooplankton, Phytoplankton, Rotifers, Crustaceans, Rivers, Lakes.
Identifiers: *FWQA methods, Sample preservation.

This report, which was first published in July 1966, discusses methods of collection, preservation, and analysis of plankton and periphyton found in lakes and rivers. All aspects of the analytical methods are discussed in detail including types of sample bottles and shipping containers, types of equipment used for the analysis, preservation and preparation of samples, and labeling of samples. (Little-Battelle)
W71-04195

ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 07B.
W71-04196

LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Fred K. Kawahara.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. January 1969. 41 p, 7 tab, 25 ref.

Descriptors: *Oil, *Sampling, *Gas chromatography, *Spectroscopy, Preservation, Solubility, Gravimetric analysis, Separation techniques, Distillation, Viscosity, Trace elements, Fresh water, Sea water, Gasoline, Asphalt, Oily water.
Identifiers: *FWQA methods, Chemical extraction, Doctor test, Infrared spectroscopy, Molecular weight, Melting point, Crude oil, Naphtha, Jet fuel, Kerosene, Paraffin wax, White oil, Cutting oil, Gas oil, Motor oil, Fuel oil, Grease.

This laboratory guide for the identification of petroleum pollutants has been prepared to provide the analyst with specific methods leading to a positive characterization of petroleum waste materials. Discussions cover: (1) sampling, which includes collection, preservation of samples, sample preparation for analysis, and concentration; (2) preliminary solubility studies; (3) separati analyses, and characterization by determination API gravity, by use of the Doctor test, by det mination of sulfur, distillation ranges, molecu weight (by the Rast method), melting point, a viscosity; and (4) identification by means of chromatography, infrared analyses, and trace co stituent analyses. The report includes numerous bles of data. (Little-Battelle)
W71-04199

FWPCA METHOD STUDY 1: MINERAL AN PHYSICAL ANALYSES - AN EVALUATION O FWPCA ANALYTICAL METHODS FOR SU FACE WATERS,
Federal Water Pollution Control Administratio Cincinnati, Ohio. Analytical Quality Control Lab J. A. Winter, and M. R. Midgett.
Available from: EPA WQO, Analytical Qual Control Laboratory, 1014 Broadway, Cincinna Ohio 45202. June 1969. 33 p, 9 fig, 2 tab, 7 ref.

Descriptors: *Reliability, *Test procedure *Water analysis, *Chemical analysis, Hydrogen io concentration, Electrical conductance, Dissolv solids, Hardness (Water), Sodium, Potassiu Acidity, Alkalinity, Chlorides, Sulfates, Laborato tests, Mathematical studies, Statistical methods.
Identifiers: *FWQA methods.

In order to validate the analytical methods em ployed by FWPCA, synthetic water samples we prepared in three ranges of concentration f determination of pH, specific conductants, tot dissolved solids, total hardness, sodium, potassiu total acidity/alkalinity, chloride, and sulfate. Th analyses were conducted by 51 analysts from laboratories in FWPCA and five non-FWPC laboratories. The results of the analyses we treated statistically to determine the accuracy an adequacy of the method employed. Detailed resul of the analyses and of the statistical treatments a given in tables and graphs. (Little-Battelle)
W71-04200

PESTICIDES IN SURFACE WATERS OF TH UNITED STATES: A FIVE-YEAR SUMMAR 1964-1968,
Federal Water Pollution Control Administratio Cincinnati, Ohio. Analytical Quality Control Lab. James J. Lichtenberg, James W. Eichelberger, Ronald C. Dressman, and James E. Longbottom.
Available from: EPA WQO, Analytical Qualit Control Laboratory, 1014 Broadway, Cincinnat Ohio 45202. September 1969. 34 p, 2 fig, 8 tab, 1 ref.

Descriptors: *Waste water (Pollution), *Dieldri *Organophosphorus pesticides, Hudson Rive *Pesticide residues, Endrin, DDT, Aldrin, Hep tachlor, Water quality, Fishkill, Delaware Rive Tennessee River, Ohio River, St. Lawrence Rive Lake Erie, Lake Michigan, Lake Superior, Missis sippi River, Missouri River, Rio Grande Rive Colorado River, Columbia River, Water pollutio sources.
Identifiers: *Chemical recovery, *Parathion, Lin dane, BHC, Chlodrane, Methyl, Parathion Fenthion, Ethion, Malathion, Trithion, DDE DDD, Heptachlor epoxide, Connecticut Rive Schuylkill River, Merrimack River, Raritan Rive Potomac River, Shenandoah River, Susquehann River, Roanoke River, Neuse River, Apalachicol River, Beauclair River, Escambia River, Oklahom River, West Palm Beach Canal, Chattahooche River, Savannah River, Clinch River, Tombigbe River, Allegheny River, Kanawha River, Monon gahela River, Wabash River, Detroit River, St Clair River, St. Mary's River, Saginaw River, Mau mee River, Illinois River, Fox River, North Platt River, Platte River, South Platte River, Yel lowstone River, Rainy River, Red River, Kansa River, Big Horn River, Atchafalaya River, Arkan sas River, Brazos River, Verdigris River, Trinit River, Bear River, Green River, Klamath Rive Sacramento River, San Joaquin River, San Jua River, Truckee River, Clearwater River, Pen

reille River, Snake River, Spokane River, Wilmette River, Yakima River, Carbamate compounds.

his report summarizes the results of five annual noptic surveys (1964-1968) for chlorinated ydrocarbon pesticides in surface water of the nited States. The analytical methods employed ere based upon standard methods established by WQA which are specific for dieldrin, endrin, DT, DDE, DDD, aldrin, heptachlor, heptachlor xpoxide, lindane, BHC, gamma-chlordane and chnical chlordane. In the 1967 and 1968 surveys, mples were also analyzed for methyl parathion, arathion, fenthion, ethion, malathion, and ithion. The results showed wide-spread occurnce of the pesticides throughout the United tates. The number of occurrences reached a peak 1966 and then declined sharply in 1967 and 968. The maximum concentrations have not exeeded permissible limits as they relate to human take directly from a domestic water supply. However, they have often exceeded the environmental mit recommended by the Federal Committee on Vater Quality Criteria. Maps and tables are included to show the distribution of the various pestides throughout the United States. (Little-Battlle)
W71-04201

WPCA METHODS FOR CHEMICAL ANALSIS F WATER AND WASTES.
ederal Water Pollution Control Administration, incinnati, Ohio. Analytical Quality Control Lab.

vailable from: EPA WQO, Analytical Quality ontrol Laboratory, 1014 Broadway, Cincinnati, hio 45202. November 1969. 280 p, 21 fig, 4 tab, 2 ref.

escriptors: *Chemical analyses, *Waste water Pollution), *Fresh water, *Saline water, *Laboraory techniques, Acidity, Alkalinity, Aluminum, rsenic compounds, Biochemical oxygen demand, alcium, Chemical oxygen demand, Chlorides, hromium, Color, Copper, Dissolved oxygen, luorides, Hardness (Water), Iron, Magnesium, langanese, Nitrogen, Nitrates, Nitrites, Oil, ydrogen ion concentration, Phosphorus, Potassim, Silica, Sodium, Solid wastes, Electrical conuctance, Sulfates, Sulfides, Water temperature, dor, Turbidity, Colorimetry, Organic compounds. dentifiers: *FWQA methods, Cadmium, Cyanide, ead, MBAS, Grease, Organic carbon, Organic trogen, Phenolics, Orthophosphate, Selenium, inc, Sample preservation, Chlorine demand, hlorine residual.

his manual describes the procedures for analysis f water selected by a team of senior scientists ithin FWPCA based on the criteria that: (1) the ethods should meet FWPCA needs, (2) they ould utilize the equipment and skills normally vailable, (3) the methods are valid, and (4) they e sufficiently rapid to permit routine analysis of rge numbers of samples. In most cases the ethods are satisfactory for the measurement of e indicated constituents in both water and waste aters and in both saline and fresh water samples. ost of the procedures included will ultimately apear in Standard Methods for Examination of ater and Waste Water, 13th Edition, and/or STM Standards, Part 23. (Little-Battelle)
71-04202

ETHOD SELECTION STUDY 1: A COMARISON OF THREE MODIFICATIONS OF HE SINGLE REAGENT METHOD FOR SOLULE ORTHOPHOSPHATE,
ederal Water Pollution Control Administration, incinnati, Ohio. Analytical Quality Control Lab.
hn A. Winter, and Robert L. Booth.
vailable from: EPA WQO, Analytical Quality ontrol Laboratory, 1014 Broadway, Cincinnati, hio 45202. April 1969. 40 p, 5 fig, 11 tab, 5 ref.

Descriptors: *Phosphates, *Water analysis, Fresh water, Sea water, Sewage effluents, Surface water, Statistical methods, Iron.
Identifiers: *Orthophosphates, *Chemical recovery, *FWQA methods, Distilled water, Chemical interference.

A round-robin test was conducted by the Analytical Quality Control (AQC) Laboratory on three modifications of the mixed reagent method of analysis for soluble orthophosphate for the purpose of establishing an FWPCA interim official method. The tests were conducted on spiked distilled water samples, spiked and unspiked river water, spiked and unspiked sea water, and, in one case, sewage effluent. Based on the data, which are included in graphs and tables, the method of Murphy and Riley gave the best precision and accuracy and the least bias and therefore was selected as the FWPCA interim official method. (Little-Battelle)
W71-04204

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Dwight G. Ballinger.
Analysis Instrumentation, Vol 7, p 242-246, May 1969. 10 ref.

Descriptors: *Laboratory equipment, *Chemical analysis, *Automation, *Instrumentation, Gas chromatography, Spectrophotometry, Volumetric analysis.
Identifiers: Atomic absorption spectrophotometer, Infrared spectrophotometer, Total carbon analyzer, Ion meters, Auto analyzer, Automatic titrators.

The application of various types of instruments to water analysis is reviewed. The instruments reviewed are the gas chromatograph which is used for the determination of trace organic contaminants including pesticides and herbicides, the atomic absorption spectrophotometer which is used for determination of metals in water, total carbon analyzers which are used for determining organic carbon content of water samples, ion meters which are used for determination of cyanide, fluoride, nitrate, chloride, sulfide, calcium and dissolved oxygen, and the infrared spectrophotometer which is used for identification of organic pollutants. Consideration is also given to the Technicon AutoAnayzer and automatic titrators which have contributed to the automation and speedup of routine analyses. Further improvements in instrumentation are needed to extend the parameters that are covered and to further reduce the amount of manual labor involved in analyzing samples. (Little-Battelle)
W71-04205

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber, and Ben H. McFarland.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. March 1969. 19 p, 8 tab, 20 ref.

Descriptors: *Water quality, *Bioindicators, *Chlorophyll, *Ohio River, *Analytical techniques, Biomass, Water pollution, Algae, Periphyton, Phosphorus, Hydrogen ion concentration, Alkalinity, Hardness (Water), Chlorides, Organic matter, Carbon, Water pollution effects, Bacteria, Periphyton, Ohio.
Identifiers: *Autotrophic Index, Chlorophyll a, Shayler Run, Organic carbon, Cincinnati (Ohio).

A review was made of the literature regarding the relationship of biomass and chlorophyll as a first step in determining the potential use of the biomass-chlorophyll ratio as an index of water quality. Laboratory studies were then begun in 1967 on samples taken at two stations above and below the major waste outfall in the Ohio River at Cincinnati. In 1968, samples taken by the FWPCA Newtown Fish Toxicology Laboratory from a small creek (Shayler Run) were included in the study. Since chlorophyll a is the only form of chlorophyll found in all algae, the biomass-chlorophyll which is termed the autotrophic index should be based exclusively on this pigment. The Autotrophic Indices for the samples taken at the two Ohio River stations were significantly different. The data obtained at the upstream station were similar to those from Shayler Run, and indicated a predominantly autotrophic periphyton. In contrast to the upstream station, the high indices at the station below the waste outfall suggested a 'consumer-type' community. The Autotrophic Index shows considerable promise as a tool in water quality studies. Data on water chemistry, Autotrophic Indices, composition of periphyton, and test methods are included. (Little-Battelle)
W71-04206

THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Cornelius I. Weber.
Transactions of the American Microscopical Society, Vol 87, No 1, p 70-81, 1968. 8 fig, 2 tab, 24 ref.

Descriptors: *Photoplankton, *Algicides, *Bactericides, Scenedesmus, Bioassay, Analytical techniques.
Identifiers: *Formalin, *Sample preservation, *Mercuric chloride, *Merthiolate, Cyclotella meneghiniana, Iodine.

The bactericidal and algicidal properties of formalin, mercuric chloride, and Merthiolate were tested using grab riverwater samples and cultures of Scenedesmus bijuga and Cyclotella meneghiniana. Formalin was bactericidal in grab samples at a concentration of 1.0%, and arrested algal growth at a concentration of 0.01% to 0.1%. Mercuric chloride was bactericidal and algicidal at 13-27 mg per liter. Merthiolate arrested algal growth at 1 mg per liter when accompanied by an equal concentration of iodine. Although not bactericidal at concentrations as high as 1 gm per liter, Merthiolate when used in combination with iodine satisfactorily stabilized algal counts in stored samples and was superior to formalin and mercuric chloride in preserving the morphology and color of the algae. The effects of formalin, mercuric chloride, and Merthiolate on bacterial count and algal growth rate are presented. (McCann-Battelle)
W71-04207

PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Cornelius I. Weber, and Donald R. Moore.
Limnology and Oceanography, Vol 12, No 2, p 311-318, April 1967. 6 fig, 22 ref.

Descriptors: *Phytoplankton, *Seston, *Diatoms, Carbon, Organic matter, Bioindicators, Water quality, Water temperature, Ohio.
Identifiers: *Organic carbon, Little Miami River, Cyclotella, Melosira, Stephanodiscus, Cincinnati (Ohio).

A yearlong study was made of the phytoplankton, seston, and dissolved organic carbon in a small, hardwater, midwestern stream. The annual cycle of cell counts and volumes followed the cycle in water temperature. The dominant algae were small, euplanktonic, centric diatoms of the genera Cyclotella, Melosira, and Stephanodiscus, which contributed an average of 63% of the cell count and 66% of the cell volume. The seston averaged 15.8% organic matter by ignition. Stream flow and particulate organic matter were positively correlated from December to April, negatively from

May to November. The photoplankton contributed an average of 38% of the particulate organic matter from May to November. The dissolved organic carbon averaged 6.4 mg/liter, and showed no seasonal cycle. (McCann-Battelle)
W71-04209

A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Water Pollution Surveillance System.
John F. Kopp, and Robert C. Kroner.
Applied Spectroscopy, Vol 19, No 5, p 155-159, 1965. 6 tab, 12 ref.

Descriptors: *Trace elements, Spectroscopy, Aluminum, *Arsenic compounds, Boron, Cobalt, Chromium, Copper, Iron, Molybdenum, Manganese, Missouri River, Ohio River, Mississippi River, Water analysis.
Identifiers: *Spectrochemical analysis, Silver, Barium, Beryllium, Cadmium, Nickel, Platinum, *Lead, Strontium, Vanadium, Zinc.

A method employing a direct reading spectrochemical procedure for the quantitative determination of 19 minor elements in water is presented. Silver, aluminum, arsenic, boron, barium, beryllium, cadmium, cobalt, chromium, copper, iron, molybdenum, manganese, nickel, platinum, lead, strontium, vanadium, and zinc are determined in concentrated water samples by the rotating disc-high-voltage spark technique. Using background as the internal standard, concentrations in the order of 0.01 to 100 mg/l in the processed samples are determined in a matter of minutes by converting the 'counts' from a sequential read-out system on a drum calculator. Recoveries of the elements from known solutions varied from 80 to 113 percent at the 90 percent confidence level. Six tables provide detailed data on the 19 trace elements. (McCann-Battelle)
W71-04211

GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
California Univ., Davis. Dept. of Environmental Toxicology.
Wendell W. Kilgore, and Earl R. White.
Journal of Chromatographic Science, Vol 8, p 166-168, March 1970. 4 fig, 9 ref.

Descriptors: *Chromatography, *Fungicides, *Chlorinated hydrocarbon pesticides, 2-4-5-T, Analytical methods.
Identifiers: Ionization detector, Botran, Chemagro 2635, Dyrene, HCB, Lanstan, PCNB, PCP, Phygon, Spergon, TCNB, TCP, 2,4,6-T, Methylation.

This study was undertaken to develop a technique suitable for the separation and detection of a mixture of fungicides on a single gas-liquid chromatography (GC) column. The chemicals were detected either as the parent structures or as their methyl ethers. The analyses were performed with: (1) An all-glass isothermal system utilizing an electron capture detector, and (2) An all-metal temperature program system utilizing a flame ionization detector. The results clearly demonstrate that mixtures of chlorinated fungicides (parent structures or derivatives) can be separated by GC as readily as most insecticides and herbicides. Chromatograms are included to show the separation of chlorinated fungicides. (McCann-Battelle)
W71-04213

THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
Miami Univ., Coral Gables, Fla. Dept. of Pharmacology.
J. L. Radomski, and Alberto Rey.
Journal of Chromatographic Science, Vol 8, p 108-114, March 1970. 7 fig, 4 tab, 6 ref.

Descriptors: *Chromatography, *Dieldrin, *Lipids, DDT, Heptachlor, Aldrin, Heptachlor epoxide, Gonads, Separation techniques, Analytical methods, Chlorinated hydrocarbon pesticides.
Identifiers: *Sensitivity, *Electron capture detector, DDD, DDE, Lindane, HCH, Blood, Brain, Liver, Kidney, Clean-up, Gas chromatography, Thin layer chromatography.

The procedures are described for the rapid analysis of chlorinated hydrocarbon pesticides in human and animal tissues utilizing the high temperature electron capture detector. The nickel 63 'hidden window' electron capture detector gives superior sensitivity to chlorinated hydrocarbons and is highly stable toward the response losses experienced with other detectors when biological samples are analyzed. The detector is best operated in the pulse mode at 60v, 3 microsec on and 270 microsec off, at 355C, utilizing prepurified nitrogen as carrier gas. Good linearity and high sensitivity are observed. Fat and blood of both humans and animals is optimally analyzed by chromatography of the hydrocarbon extract without the use of clean-up. The analysis of brain, liver, kidney, and gonadal tissue is best carried out utilizing a TLC clean-up step which readily removes the interferences present. Very high sensitivities are obtained using these methods. (McCann-Battelle)
W71-04214

MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
Fred K. Kawahara.
Analytical Chemistry, Vol 40, No 6, p 1009-1010, May 1968. 1 fig, 3 tab, 9 ref.

Descriptors: *Phenols, *Gas chromatography, *Ethers, Analytical methods, Industrial wastes, Ethers, Aldrin.
Identifiers: *Mercaptans, *Electron capture gas chromatography, Thioethers.

Traces of mercaptans and phenols adversely affect the palatability of water. Sensitive and rapid methods are needed for measuring these compounds which constitute a small portion of the complex weak acid fraction. However, a large portion of the weak acid fractions, isolated from the organic materials extracted from river water, is neither phenolic nor mercaptan. Several interesting approaches have been investigated to develop either faster or selective techniques of analysis. A highly selective method is required because of the numerous contaminants in the weak acid fraction. The conversion of phenol and mercaptan to a derivative which can exhibit electron capture response seemed to offer unique advantages for their measurement. Ethers and thioethers, derived from phenols and mercaptans, respectively, with alpha-bromo-2,3,4,5,6-pentafluorotoluene exhibit excellent electron capture response. This property accounts for excellent measurements in the presence of impurities. Only phenols, mercaptans, and acids will react rapidly with the fluoro-organic reagent under the described conditions. Derivatives of phenols and mercaptans are stable in water and are amenable to gas-liquid chromatographic separations. (McCann-Battelle)
W71-04218

A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 07B.
W71-04219

5B. Sources of Pollution

THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.

Corps of Engineers, Office of Appalachian Studies, Report, Vol 18 of 25 Vol, Appendix C, June 1969. 45 p, 10 fig, 2 plate, 1 tab, 22 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Water chemistry, *Appalachian Mountain Region, Water resources development, Oxidation, Pyrite, Sulfides, Iron compounds, Iron bacteria, Sulfur bacteria, Planning.
Identifiers: Appalachian redevelopment.

Appendix C is one of nine appendices to the 25-volume series, 'Report for development of water resources in Appalachia,' and furnishes information on mine drainage pollution. Effluent from coal mines is the major source of water pollution in most of the Appalachian region. Pollution results from mineral acidity created when pyritic material, exposed during mining, is oxidized and the products are dissolved and carried into streams and lakes. The acid waters are very corrosive to metal and damage concrete structures; the low pH is harmful to aquatic life, reducing or eliminating fish and otherwise lowering an area's recreational potential. This appendix and its five report attachments discuss chemical complexities in formation of acid mine drainage, identify its extent and intensity, and present measures to correct or better control the problem. Attachment A, an atlas of drainage incidence compiled by FWPCA, is a summary reference. Attachment B is an annotated bibliography of pertinent literature extant in 1967. Attachments C and D briefly analyze factors that contribute to formation of mine pollution. Attachment E surveys control costs for acid mine drainage using various techniques. (See also W71-03873 thru W71-03877) (Lang-USGS)
W71-03872

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio.

Attachment A to Appendix C-The Incidence and Formation of Mine Drainage Pollution, Federal Water Pollution Control Administration Report Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967, (Rev 1969). 261 p, 62 fig, 28 tab, 43 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Mine drainage, *Water chemistry, *Appalachian Mountain Region, Data collections, Oxidation, Pyrite, Iron compounds, Stream improvement, Planning.
Identifiers: Appalachian redevelopment, Coal mine drainage.

Coal mine drainage pollution is documented for 1 stream basins and the Anthracite area of northeastern Pennsylvania. Coal deposits underlie more than 72,000 sq mi of Appalachia, about 40% of the total area. Effluent from mining is major source of water pollution in most of the Appalachian region. About 10,500 mi of streams are significantly affected by mine drainage pollution, 6,700 mi of these on a continuous basis. The Monongahela, Allegheny and Susquehanna-Delaware River basins of Pennsylvania, West Virginia, and Maryland contain about 68% of the mine drainage acidity in Appalachia, and 43% of the affected miles of stream are in these watersheds. Inactive underground mines contribute 52% of the acid, active underground mines 19%, inactive surface mines 11%

d active surface mines 1%. Refuse piles and coal ocessing plants also contribute. In some places ost of the pollution in a watershed comes from a w sources. While changes have occurred in mine ainage pollution loads (historically), substantial creases have not occurred within the past 25 yr. ater quality data are given in 30 tables. The tential for further pollution from mining is lected by the fact that recoverable reserves of uminous coals in Appalachia are equal to 440 es the 1964 production and seven times the al cumulative production from the start of min- to 1965. (See also W71-03872) (Lang-USGS)
71-03873

REVIEW OF CURRENT RESEARCH ON AL MINE DRAINAGE IN APPALACHIA,
reau of Mines, Pittsburgh, Pa. Area 1 Mineral sources Office.
bert W. Stephan, and Walter C. Lorenz.
tachment B to Appendix C - The Incidence and rmation of Mine Drainage Pollution, Bureau of nes Report, Vol 18 of 25 Vol on Development of ter Resources in Appalachia, 1967. 26 p, 14 ref.

scriptors: *Acid mine water, *Water pollution rces, *Water pollution control, *Reviews, ibliographies, Water chemistry, Oxidation, rite, Iron compounds, Iron bacteria, Sulfur bac- ia.
ntifiers: *Appalachian redevelopment.

e status of current research methods for abate- nt or control of acid mine drainage is reviewed. aluation is made of present day technology for ntrol of the drainage waters. In 1962 about 3.2 lion tons of sulfuric acid was being discharged ually into streams from active and abandoned l mining operations in Appalachia. Such pollu- n degrades the value of the streams for domestic l industrial water use as well as for recreation. ne refuse piles and other operations also oduce acid waters. Work is described for four nonstration projects - one near Elkins, W. Va. l three in Pa. - in which mine sealing, direct iron noval, ozone oxidation, impoundment oxidation, nineralization, flash distillation, and reverse os- sis are methods being tried. Deep well injection mine waters offers limited possibilities for per- nent disposal. A literature review of research is sented in an annotated bibliography. (See also 1-03872) (Lang-USGS)
1-03874

CTORS THAT AFFECT THE FORMATION COAL MINE DRAINAGE POLLUTION IN PALACHIA,
reau of Mines, Pittsburgh, Pa. Area 1 Mineral source Office.
lter C. Lorenz, and Robert W. Stephan.
achment C to Appendix C - The Incidence and rmation of Mine Drainage Pollution, Bureau of nes Report, Vol 18 of 25 Vol on Development of ter Resources in Appalachia, 1967. 17 p, 53 ref.

scriptors: *Acid mine water, *Water pollution rces, *Water pollution control, *Reviews, bliographies, Water chemistry, Oxidation, ite, Iron compounds, Iron bacteria, Sulfur bac- a.
ntifiers: *Appalachian redevelopment.

al mine drainage pollutes more than 5,000 miles streams and 13,000 acres of ponds in Ap- achia. Pyrite formed contemporaneously with formation of coal; it is associated with coal, and rocks adjacent to the coal. It is oxidized in the sence of oxygen and moisture, and the oxidation ducts when dissolved in water are stream pollu- ts. Current research on pyrite oxidation includes dies of electrochemical reactions, and the ef- ts of iron-oxidizing bacteria on this oxidation. e also W71-03872) (Knapp-USGS)
1-03875

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
Walter C. Lorenz, and Robert W. Stephen.
Attachment D to Appendix C - The Incidence and Formation of Mine Drainage Pollution, Bureau of Mines Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967. 21 p, 100 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Reviews, *Bibliographies, Water chemistry, Oxidation, Pyrite, Iron compounds, Iron bacteria, Sulfur bacteria.
Identifiers: *Appalachian redevelopment.

A survey of the literature and current research on the oxidation of pyrite, both chemical and bacterial, is presented to indicate progress in this field. Pyrite oxidizes when it is an anode. Oxidizing potential for pyrite has been described as being between 560 and 860 millivolts. Factors affecting the rates of pyrite oxidation are oxygen concentration, particle size, temperature, moisture, pH (hydrogen-ion concentration) and Eh (electrode potential) of the reaction, and a possible catalyst. Postulated characteristics of the oxidation reaction are based upon chemisorption of oxygen, high oxidation potential, and bacterial catalyst. Iron- and sulfur-oxidizing bacteria increase the rate of oxidation of pyrite. These bacteria oxidize the ferrous ion to the ferric state. Among the promising lines of research are studies of the electrochemical properties, the effects of bacteria, and surface treatment of pyrite. (See also W71-03872) (Knapp-USGS)
W71-03876

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
Robert W. Stephan, and Walter C. Lorenz.
Attachment E to Appendix C - The Incidence and Formation of Mine Drainage Pollution, Bureau of Mines Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967. 35 p, 8 fig, 21 tab, 21 ref.

Descriptors: *Cost analysis, *Water pollution control, *Appalachian Mountain Region, *Acid mine water, Neutralization, Waste water disposal, Injection wells, Water treatment, Ion exchange, Chemical precipitation.
Identifiers: *Appalachian redevelopment.

This report presents capital investment and operating costs on the various processes and methods available for the abatement of pollution due to acid coal mine water drainage. The abatement measures include neutralization, iron removal, demineralization, and physical disposal by deep well injection. Cost data are presented on the reclamation of land disturbed by surface and strip mining operations. A summary of available data relating the various size plants for treating acid mine water is reported for the various processes for abatement of pollution. The costs of pollution abatement measures as determined in this survey range from less than $0.07/1,000 gal. to $1.13/1,000 gal. of acid mine water treated. (See also W71-03872) (Knapp-USGS)
W71-03877

ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
Michigan Water Resources Commission, Lansing. Dept. of Natural Resources.

Department of Natural Resources, August 1969. 41 p, 12 fig, 9 tab, 2 ref.

Descriptors: *Impaired water quality, *Pollutant identification, *Surveys, *Water pollution sources, Benthos, Sludge worms, Biochemical oxygen demand, Cyandphyta, Domestic wastes, On-site data collections, Michigan.
Identifiers: *Combined sewer overflows, *Ecorse River.

A survey was initiated in May 1969 to evaluate the present water quality of the Ecorse River and relate existing conditions to cause. The Ecorse River Basin is located in a densely populated portion of southeastern Michigan. Its natural drainage area of 46 square miles is located entirely in Wayne County and includes portions of the southern Detroit metropolitan area. The North Branch and the South Branch join to form the main stream three-fourths of a mile west of the Detroit River. The studies confirmed that the lower Ecorse River system is in a severely degraded condition. The principal factors causing degradation are storm water overflows which originiate from combined sewer systems. High biochemical oxygen demand of the Benthic sludge, combined with the BOD of suspended materials and algal respiration, caused extermely low dissolved oxygen levels during the survey. The largest source of the BOD is the Benthic sludge and thus represents a continuous drain on the stream's oxygen resources. Biological studies of the plankton community revealed excessive algal densities, 93 percent of which were blue-greens. Benthic samples from the lower reaches contained only pollution tolerant sludgeworms, indicating an environment in an extreme state of degradation. (Poertner)
W71-03907

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering; and New York State Dept. of Conservation, Syracuse. Div. of Water Resources.
Charles R. Jenkins, and Henry C. Carroll.
In: Proceedings of the West Virginia Academy of Science, 1969, 44th Annual Session held at West Liberty State College, West Virginia, Apr 10-12, 1968, Vol 41, p 286-293, May 1970. 8 p, 9 fig, 1 tab, 5 ref.

Descriptors: *Acid mine water, *West Virginia, *Water pollution sources, Mine drainage, Water analysis, Water quality, Stream gages, Water chemistry, Weirs, Mine acids, Mine wastes, Streamflow, Water yield.
Identifiers: Acid mine drainage.

The Left Fork of Little Sandy Creek basin, between Fellowsville and Tunnelton, West Virginia, was surveyed for the location of mine drainage sources. At least 30 out of a total of 47 potential sources of drainage were found to produce acid at some time during the year. Thin-crested 90 deg weirs installed along with permanent staffs were found to be sufficiently accurate for measuring flow fluctuation from the mines. A flow meter was used in determining the relationship between acid load and flow from a mine. Tests were also run for pH, alkalinity, hardness, sulfates, iron, and aluminum. The acid load or production was found to be directly proportional to flow. Sulfates, iron, and aluminum were found to vary much the same as acidity. Hardness was not closely associated to acidity concentration but generally was reduced at higher flow due to a dilution effect. The pH remained relatively constant and independent of flow. A summation of conditions from individual mines was found to account closely with conditions observed in the receiving stream. (Knapp-USGS)
W71-03938

MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
Arizona Univ., Tucson.
Wallace H. Fuller, and Michael F. L'Annunziata.
Atomic Energy Commission Contract AT (11-1)-947. Soil Science, Vol 107, No 3, March 1969, p 223-230. 3 tab, 5 fig, 7 ref.

Descriptors: *Chelation, *Strontium radioisotopes, *Algae, *Fungi, *Calcareous soil, Soil water, Soil water movement, Leaching, Arid lands, Depth, Cyanophyta, Chlorophyta, Sierozems, Soil microbiology, Distribution patterns, Soil profiles.
Identifiers: *Radiostrontium, *Algal-bound radiostrontium, *Fungal-bound radiostrontium, *Microbial activity, *Radiostrontium complexes, DTPA, Soil water profile.

This report evaluates the effect of microbial activity on movement of algal- and fungal-bound raiostrontium, the effect of DTPA on Sr super 89 mobility adsorbed by algal and fungal cells in a calcareous soil, and extra-cellular algal excretions as Sr super 89 complexing agents. Leaching with a water-formaldehyde and water solution caused little Sr super 89-bound movement by Aspergillus niger (fungi), Rhisopus arrhizus (fungi), Oscillatoria bijuga (blue-green alga) and Chlorococcum sp. (a green alga) in Mohave sandy loam. Leaching with 0.067 M DTPA solution displaced from 0.2 to 1.6 percent of the algal- and fungal-bound Sr super 89 below a 20-cm soil depth. The Sr super 89 profile distribution remaining in the leached soil contrasted with the DTPA-treated and the water-treated soil columns. Wherever DTPA was added Sr super 89 moved downward, whereas in the water-treated control Sr super 89 remained in the upper 2.5 cm. Negatively charged Sr super 89 complexes formed from excretions of the desert soil alga Anacystis menegh are shown. Tables indicate Sr super 89 movement with respect to algal and fungal tissue, biologically bound Sr super 89 from DTPA treatment and total extractable Sr super 89. Figures are included of exchangeable and fixed Sr super 89 with soil depth for various biological soil treatments, and evidence of Sr super 89 in a cell-free Anacystis medium as negative complexes. (Popkin-Arizona)
W71-04067

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 05C.
W71-04116

MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
Geological Survey, Raleigh, N.C.
Harry E. LeGrand.
In: Agricultural Practices and Water Quality, Iowa State University Press, Ames, 1970, p 303-313. 2 fig, 18 ref.

Descriptors: *Path of pollutants, *Farm wastes, *Water pollution sources, *Groundwater, *Agricultural chemicals, Fertilizers, Pesticides, Nutrients, Soil water, Soils, Seepage, Soil chemistry, Absorption, Soil mechanics, Water quality, Soil properties, Water wells, Water table, Environmental effects, Water chemistry, Infiltration.
Identifiers: *Agricultural pollutants.

The volume of groundwater polluted by plant nutrients, animal wastes, and pesticides appears to be small. Numerous small polluted zones of water occur in the upper part of the zone of saturation. Sufficient safeguards are available to minimize groundwater pollution to the extent that good agricultural practices should not be deterred. The unsaturated zone above the water table attenuates almost all of the foreign bodies that are potential pollutants of the underlying groundwater. Chemical fertilizers, animal wastes, and pesticides vary greatly in their tendency to degrade in ground environments. The following favorable environmental factors tend to reduce the changes of pollution of water from wells and springs: (1) A deep water table, which (a) allows for sorption of pollutants on earth materials, (b) slows subsurface movement of pollutants, and (c) facilitates oxidation or other beneficial 'die-away' effects. (2) Sufficient clay in the path of pollutants so that retention or sorption of pollutants is favorable. (3) A gradient of the water table beneath a waste site away from nearby wells. (4) A great distance between wells and wastes. (Woodard-USGS)
W71-04121

DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 02A.
W71-04134

VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOW-PACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
International Atomic Energy Agency, Vienna (Austria); and Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02A.
W71-04135

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04191

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber, and Ronald L. Raschke.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. February 1970 (Reprint). 22 p, 4 fig, 5 tab, 24 ref.

Descriptors: *Water quality, *Bioindicators, *Sampling, *Periphyton, Analytical techniques, Diatoms, Phytoplankton, Water pollution effects, Ohio River, Klamath River, Monitoring.
Identifiers: *Artificial substrates, *FWQA methods.

This report is a reprint of a report first published in September 1966. A description is given of a floating sampler that was used to collect periphyton in the Ohio River at Cincinnati. The rate of colonization of glass slides by diatoms was determined, and the periphyton and plankton diatom communities were compared. The periphyton diatoms were dominated by species of nitzschia and navicula, whereas the plankton diatoms consisted largely of species of melosira and cyclotella. Glass slides were also exposed above and below a group of polluted outfalls on the upper Klamath River, Oregon to show how the number of diatoms present served as indicators of water quality. The sampler is shown schematically, and the data regarding the number of periphyton and plankton present in the Ohio and Klamath Rivers, as well as the species, are included in figures and tables. (Little-Battelle)
W71-04194

PESTICIDES IN SURFACE WATERS OF THE UNITED STATES: A FIVE-YEAR SUMMARY 1964-1968,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04201

ACCUMULATION OF PHOSPHATES IN WATER,
Agricultural Research Service, Morris, Minn. North Central Soil Conservation Research Center.
Robert F. Holt, Donald R. Timmons, and Joseph J. Latterell.
Journal of Agriculture and Food Chemistry, Vol 18, No 5, p 781-784, 1970. 1 tab, 37 ref.

Descriptors: *Phosphates, *Path of pollutants, *Eutrophication, *Leaching nutrients, Fertilizers, Precipitation (Atmospheric), Runoff, Animal wastes, Surface waters, Soil erosion, Nutrients, Algae, Lake Superior, Water Pollution sources, Minnesota, Washington, Connecticut.
Identifiers: Illinois River, St. Louis River, Black River (Minnesota), Lake Washington (Washington), Linsley Pond (Connecticut), Lake Zoar (Connecticut), Lake Minnetonka (Minnesota), Big Stone Lake (Minnesota), Lake Crystal (Minnesota).

Natural and agricultural sources of phosphorus to surface waters include percipitation, animal wastes, fertilizers, and land runoff. The actual contribution from these sources is shown to be quite low. However, the concentration of phosphorus required to support profuse algal blooms is so low that the limited amounts supplied are sufficient to exceed this requirement. Eroded soil delivers appreciable amounts of phosphorus to surface waters, but the soil materials capacity to sorb phosphorus results in little tendency for release of this source into the water. Bottom sediments appear to be a sink for dissolved orthophosphate that is supplied to surface waters. Leaching of vegetation can supply relatively large amounts of phosphorus to lakes and streams. Deep incorporation of phosphatic fertilizers materially reduces the concentration of phosphorus in runoff waters as compared to shallow incorporation. Phosphorus concentrations in several lakes and streams are shown. (McCann-Battelle)
W71-04216

5C. Effects of Pollution

ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
Bureau of Sport Fisheries and Wildlife, Cook, Washington. Western Fish Nutrition Lab.
Laurence M. Ashley.
The Progressive Fish-Culturist, Vol 32, No 2, 1970. 109 p.

Descriptors: Laboratory equipment, Fish physiology, Water pollution effects, *Iron compounds, *Chlorides, *Sulfates, Juvenile fishes.
Identifiers: *Goldfish, Carassius auratus.

Goldfish (Carassius auratus) weighing 13-28 gm. were exposed to ferrous or ferric chlorides or sulfates dissolved in distilled water. Salt content ranged from 5-100 milligrams per liter. Iron salts were most harmful immediately after they were in solution. Gill blockage was most severe at this time, but was reversible. Fish responded similarly to exposure to the four iron salts tested. (Wahtola-Washington)
W71-03851

STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
Wyoming Game and Fish Research Lab., Laramie.
Douglas L. Mitchum, and Tom D. Moore.
Final Job Completion Report, Research Project Segment, Project No FW-3-R-13, 1966. 32 p, 12 ref, 12 tab, 10 fig.

Descriptors: *Water pollution effects, *Fish, *Mine wastes, Trout, *Aquatic life, *Invertebrates, Toxicity, Periphyton, Plankton, Benthos.
Identifiers: Radiation, *Uranium.

The extent and effect were studied of pollution by uranium mine effluent on fish and other aquatic organisms in the Medicine Bow River and contributing streams. Samples of water, bottom mud, plankton, benthic organisms and aquatic plants were collected. Fish samples were collected only in July. The naturally occurring levels of uranium, in streams included in this study were determined to be about 5 ppb. Uranium concentrations at the various stations affected by the mine effluent ranged between 2,000 ppb and 60 ppb. Data in-

cated that these relatively high uranium levels ly be toxic to trout. The mine effluent did not ap- ar to have any apparent adverse affect on plank- n, periphyton, bottom fauna organisms, and fish ecies other than trout. Accumulated radiation uld not be detected in bones of the fish ecimens collected from the various stations. ndings show that uranium mine pollution existed the Medicine Bow River drainage area and a tentially serious pollution problem existed wnstream from the study area. (Wahtola-ashington)
71-03852

CHAMBER FOR OFFERING ALTERNATIVE ONDITIONS TO SMALL MOTILE AQUATIC NIMALS,
ckholm Univ. (Sweden). Asko Lab.
rn Ganning, and Fredrik Wulff.
helia, Vol 3, p 151-160, 1966. 5 fig, 7 ref.

scriptors: *Laboratory equipment, Copepods, quatic animals, Aquatic microorganisms, ustaceans, Daphnia, Temperature, Salinity.
entifiers: Nitocra spinipes, Daphnia magna, Phyl-pods.

preference chamber especially adapted for use h small free-living aquatic animals is described. a small open plexiglass chamber with water inlets the ends and a common outlet in the middle the perimental animals are offered alternative test lutions. The test solutions are kept at a constant ter level 2-3 mm above the bottom, and a sharp d well defined gradient is established in the mid- e of the chamber. During experiments it is possi- e to observe very small animals with a stereo- croscope. Temperature, salinity and oxygen eference tests have been carried out. Small rock- ol crustaceans were offered different test solu- ns and they have so far always very clearly own preference for one of the alternatives. Vahtola-Washington)
71-03853

IE EFFECT OF SOME SOLVENTS ON OWER WATER ANIMALS AND ON FISHES,
zkumny Ustav Rybarsky a Hydrobiologicky dnany, Prague (Czechoslovakia).
Havelka, and O. Albertova.
letin VUR Vodnany, Vol 2, p 11-15, 1970. 2 ref.

scriptors: *Water pollution effects, *Solvents, quatic animals, *Fishes, Temperature, Labora- y equipment, Daphnia, Worms, Toxicity.
entifiers: Propyleneglyco, Cyclohexanon, ethylcyclohexanon, CCl4, *Daphnia magna, ubifex tubifex, *Lebistes reticulatus.

sults of the determination of harmless, harmful d lethal concentrations of eleven technical sol- nts, used in the technological production ocesses in chemical plants, on water fleas aphnia magna), pink worms (Tubifex tubifex), d Lebistes reticulatus. The values obtained were rived from trials under laboratory conditions. As uent, stabilized tap-water was used. In the practi- use of the results described, when the effect of vage water on the quality of natural waters is termined, lower concentrations should be osen with a view to the physical and chemical operties of the recipient subject to study. Due to difficult chemical identification and determina- n of solvents in sewage waters and contaminated ipients, the most unfailing demonstration of ir harmfullness to water fauna are toxicological ts of sewage and polluted natural waters. (Wah- a-Washington)
71-03854

ORSE RIVER WATER QUALITY STUDY, AY-JULY, 1969.
chigan Water Resources Commission, Lansing.
pt. of Natural Resources.
r primary bibliographic entry see Field 05B.
71-03907

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
Avco Economic Systems Corp., Washington, D.C.
Jerry C. Cleveland, Ralph H. Ramsey, Paul R. Walters, and Gary L. Miessler.
Available from NTIS as PB-197 169, $3.00 in paper copy, $0.95 in microfiche. Completion Report, 1970. 248 p, 71 tab, 20 fig, 40 ref, 4 append. OWRR Project C-1743 (No. 3164) (1).

Descriptors: *Storm water runoff, *Water pollution control, *Water quality control, *Mathematical models, *Analytical technique, Runoff forecasting, Land use, Soil contamination, Rain water, Erosion control, Watershed management, Environmental sanitation, *Urbanization, Municipal wastes.
Identifiers: Storm water pollution prediction, Urban storm water pollution, Storm water abatement analysis, *Storm water pollution control, Land activity pollution, Urban hydrology, Water pollution analysis, Structural pollution abatement measures, Non-structural abatement management.

The purpose of this study is to provide a procedure to enable prediction of storm water pollution from land activity, precipitation and runoff in an urban areas. The procedures presented in this study will enable the city planner and civil engineer to predict quantitative and qualitative pollution loads resulting from surface storm water runoff to a receiving stream. The study presents ten mathematical models for this purpose and evaluates them by application to several selected demonstration cities. Also presented are criteria for pollution control strategies and for assessment of various structural and non-structural control measures, their general effectiveness and costs. Guidelines are discussed for the use of these procedures and development of an optimal water pollution control plan. The study concludes that: (1) storm water pollution prediction models are feasible but of limited application unless adequate data are available on hydrological, precipitation and runoff characteristics, as well as land activity detail for representative metropolitan areas, and (2) storm water pollution control for most effectiveness should relate to the specific characteristics of an urban area. Maximum economies will derive from pollution abatement measures taken during the early stages of area development.
W71-03917

THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. A. Bentley, and R. B. Livingston.
Available from NTIS as PB-197 115, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Water Resources Research Center, Publication No 11 (1970). 80 p, 6 tab, 31 fig, 9 ref. OWRR Project A-023-MASS (1).

Descriptors: *Eutrophication, Alkalinity, Conductivity, Massachusetts, Lakes, *Aquatic plants, Nutrients, *Trophic level, Plant growth, Water pollution effects.
Identifiers: Plant distribution.

The growth and distribution of the aquatic vascular plants in nine lakes in western Massachusetts were examined in the field for two growing seasons. The objective of the study was to relate the growth and distribution of the vegetation to trophic levels in acid and alkaline lakes. Environmental parameters monitored included pH, total alkalinity, Secchi transparency, temperature, dissolved oxygen and conductivity. Nutrient levels were found by analysis of surface lake waters and plant shoot tissues for nitrogen and phosphorus. No significant correlations were obtained in these analyses. The distribution of the aquatic vegetation was correlated with total alkalinity and conductivity. Three groups of species were noted, those of waters with an alkalinity greater than 40 ppm CaCO3, those of waters with an alkalinity less than 40 ppm CaCO3, and those occurring regardless of alkalinity. Substrate also exerted a strong influence on plant distribution. No plants were found growing below the thermocline in the lakes sampled. Vegetative growth of the aquatic plants generally followed a standard growth curve. The standing crop was correlated with growth form and depth. Standing crops ranged from 0.3 to 420 g/m2 dry wt. Some difficulty was encountered in correlating plant growth with other parameters of trophic level.
W71-03918

INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
Arkansas Univ., Fayetteville. Dept. of Zoology.
R. V. Kilambi, J. Noble, and C. E. Hoffman.
Available from NTIS as PB-197 119, $3.00 in paper copy, $0.95 in microfiche. Preprint, Proceedings of the 24th Annual Conference, S. E. Association of Game and Fish Commission, 1970. 11 p, 4 tab, 4 fig, 12 ref. OWRR Project A-007-ARK (6).

Descriptors: *Photoperiodisms, *Temperature, Growth, *Channel catfish, Food conversion, *Catfishes, Fishes, Fish food organisms.

A total of 275 channel catfish, measuring on the average of 21.4 mm in total length were raised in the laboratory for 120 days under controlled temperatures of 26, 28, and 32 C with 10-hr and 14-hr photoperiods. Data on growth, food consumption, food conversion efficiency, and water quality were collected at 15-day intervals. Analysis of length-weight relationship showed that the experimental conditions had no effect on body shape. The fish under 28C-10L had slow growth in length throughout the study period. Variations in food consumption and food conversion efficiency in 15-day intervals were discussed. Average food consumption and food conversion efficiency for the entire study period were discussed in relation to temperature-photoperiod combinations. The fish at 28 and 32 C consumed more food under 10-hr than under 14-hr light conditions. There was a direct relationship between photoperiod and food conversion efficiency for the fish at all the three temperatures. Based on overall evaluation of growth, food consumption, food conversion efficiency, water quality, and mortalities, it was concluded that the optimum condition for raising channel catfish was at 32 C under a 14-hr photoperiod.
W71-03920

WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
Maine Univ, Walpole, Ira C. Darling Center for Research, Teaching and Service.
David Dean, and Michael A. Mayurkiewicz.
Available from NTIS as PB-197 121, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, June 1970. 31 p, 11 tab, 9 fig, 11 ref. OWRR Project A-011-ME (5).

Descriptors: *Benthic, Fauna, Benthos, *Estuaries, Fish, Larvae, Maine, Sediments, Water quality, *Larvae, Growth stage, Estuarine environment, *Aquatic environment, Water pollution, Water pollution effects.
Identifiers: Fish growth, Penobscot estuary, Damariscotta estuary, Sheepscot estuary.

This is a study of the relationships between water quality and benethic invertebrates in the Penobscot, Damariscotta and Sheepscot estuaries, representing heavily polluted, moderately polluted and relatively unpolluted conditions, respectively. Preliminary hydrograhic, sedimentary and faunal surveys were conducted to determine comparable areas in each estuary to be analyzed for interaction between level of pollution and invertebrate benthic fauna present. Field studies conducted in each area included an analysis of the qualitative and quantitative distribution of benthic invertebrates, the seasonal composition of the meroplankton, the set-

tlement of larvae and the hydrography of the area. Laboratory studies included: (1) the determination of particle size distribution of sediments and the amount of volatile solids present; (2) the facility with which different indigenous species of benethic invertebrates can be cultured in the laboratory; (3) the temperature, dissolved oxygen and salinity tolerances of larvae and adults; (4) experiments on temperature as a factor influencing the spawning of adults; (5) the influence of different substrates upon larval settlement; (6) the effect of water quality upon survival, reproduction, development and growth of benethic invertebrates.
W71-03922

THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
Missouri Water Resources Research Center, Columbia.
Arthur Witt, Jr., Robert S. Campbell, and James R. Whitley.
Available from NTIS as PB-197 265, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, August 31, 1970. 99 p, 21 tab, 15 fig, 21 ref, append. OWRR Project A-020-MO (1).

Descriptors: *Thermal pollution, *Acid mine water, *Fish harvest, *Fish reproduction, *Growth rates, *Periphyton, Primary productivity, Limnology, Fish migration, Benthos, Reservoirs, *Heated water, Thermal stratification, Temperature, Bass.
Identifiers: Shad.

Acid water caused low mortiality of fishes only at the point of inflow. Acid water of high specific gravity could be traced within the lake by sulfate levels and conductance until diluted. Thermal stratification occured in the reservoir, but was transitory due to wind action and mixing. Movement of heated water was dependent on wind direction, which was evident by changing patterns of open water during ice cover. A maximum temperature of 34C and minimum of 10C was recorded in an arm of the reservoir that received heated water. Growth rates of young-of-the gizzard shad were not influenced by the heated water. Gizzard shad and largemouth bass concentrated in the heated water during winter and maintained a winter fishery. The heated water affected gonadal development and accelerated the time of spawning of largemouth bass. There was no difference between rates of accrual of Aufwuchs in heated and unheated water in the reservoir.
W71-04019

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05D.
W71-04072

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
Engineering-Science, Inc., Arcadia, Calif.
Harvey F. Ludwig, and P. N. Storrs.
Water Research, Vol 4, No 11, p 709-720, November 1970. 12 p, 14 ref.

Descriptors: *Water pollution effects, *Sea water, *Reviews, Waste disposal, Eutrophication, Estuaries, Bays, Water pollution control, Water pollution treatment, Publications, Surveys.
Identifiers: Marine outfalls.

Recent studies of the effects of waste discharges on marine waters are reviewed. There is a common pattern in the variations of abundance and species diversity with distance from the outfall. In the immediate vicinity of the outfall inhibition of biological populations is usually observed. This is evidenced by very low values of both abundance and diversity, and it is particularly apparent for fixed or relatively non-mobile organisms. At some distance from the outfall organism abundance may increase greatly to levels significantly above the average for the area. In this region the species diversity will also have increased, although it will still be less than the area average. Finally, at a greater distance from the outfall the levels of both diversity and abundance return to the normal 'background' level. It is inferred that most waste waters, as presently discharged, have a toxic or inhibitory effect in addition to their biostimulatory characteristics. The toxicity of the waste water is controlling in the immediate vicinity of the outfall, but with the reduction of toxicity by dilution, the biostimulatory effects come to the fore permitting the increased organism abundance noted above. Over the past decade a great deal has been learned about effects of waste materials on marine receiving waters. (Knapp-USGS)
W71-04114

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
California State Dept. of Water Resources, Los Angeles. Southern District.
Jack J. Coe.
Journal of American Water Works Association, Vol 62, No 12, p 776-783, December 1970. 8 p, 9 fig, 5 tab, 12 ref.

Descriptors: *Landfills, *California, *Water pollution sources, Path of pollutants, Water pollution control, Carbon dioxide, Organic matter, Water quality, Groundwater movement, Waste disposal, Biodegradation.
Identifiers: Sanitary landfills.

Municipal solid wastes are produced in California at a rate of about 7 lb/per capita per day. Most of this waste is disposed of in sanitary landfills. Gas movement rates were found to be 0.22 to 0.8 ft per day vertically and 0.24 to 1.4 ft per day horizontally in undisturbed alluvial soils. Groundwater is often imparied by refuse decomposition products whenever water is allowed to pass through the decomposed material in such quantities as to eventually reach the groundwaters of the area. Leachate impairment of groundwater causes temporary increases in organic material and permanent increases in mineral constituents. Impairment is typified by increases in total dissolved solids, total hardness, chloride, and sulfate. Such increases may last several years. Carbon dioxide effects on groundwater are increases in hardness and bicarbonate. Depending on the pH after carbon dioxide adsorption, water may become corrosive. By modifying a site-usually by the construction of a physical barrier-the groundwater can be protected. (Knapp-USGS)
W71-04116

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber.
Journal of Phycology, Vol 6, p 149-153, 1970. 3 fig, 2 tab, 13 ref.

Descriptors: *Phytoplankton, *Diatoms, *Bioindicators, *Water quality, Sampling, Water temperature, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Hardness (Water), Phosphorus, Nitrogen, Chlorides, Sulfates, Water pollution, Delaware River, Hudson River, Ohio River, Mississippi River, Missouri River, Columbia River.
Identifiers: *Little Miami River, *Microsiphona potamos, Connecticut River, Susquehanna River, Chattahoochee River, Maumee River, Great Miami River, Scioto River, Wabash River, Illinois River, Arkansas River, Big Sioux River, Red River, Sacramento River, San Joaquin River, Snake River, Sample preservation.

Analysis of weekly surface grab samples taken from the Little Miami River at Water Pollution Surveillance System Station 90 showed the presence of a new centric diatom microsiphona potamos gen. et sp. nov. (family Coscinodiscaceae). The cells are three to four microns in diameter, four to eight microns long, and contain two to several plate-like chromatophores. They occur singly, or are held together in short chains by the old girdle bands and by numerous apiculi that connect the opposing values of adjacent daughter cells. Cell densities in the grab samples ranged from 29 to 20,140 per ml during the period May 18 to December 14, 1966. Total nitrogen and phosphorus concentration over the sampling period averaged 2.3 and 0.46 mg/l, respectively, indicating high levels of available nutrients. The water was also highly alkaline. Microsiphona potamos was not observed until the water temperature reached 18C and was abundant until water temperatures fell below 10C. The same species has been observed in grab samples from rivers throughout the United States, suggesting that it is an important element of the freshwater phytoplankton of the United States. Descriptive features and electron micrographs of the diatom are included as well as data on the temperature DO, BOD, total phosphorus, total nitrogen, chloride, alkalinity, hardness, and sulfate levels. (Little-Battelle)
W71-04193

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04206

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
William T. Mason, Jr., and Philip A. Lewis.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. Paper 16th Annual Meeting of the Midwest Benthological Society, Wisconsin University, Madison, April 18-19, 1968. 14 p, 2 tab.

Descriptors: *Bioindicators, *Sampling, *Benthic fauna, *Ohio River, Bioassay, Diptera, Mayflies, Lacewings, Crustaceans, Annelids, Mollusks, Nematodes, Stoneflies, Monitoring, Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, Illinois, Sampling.
Identifiers: *Kanawha River, Basket sampler, Ekman dredge, Petersen dredge, Monongahela River, Allegheny River, Wabash River, Trichoptera, Odonata, Coleoptera, Bryozoa, Collenterata, Porifera, Turbellaria, Artificial substrates.

Macroninvertebrate populations in the Ohio River have been sampled since 1963 for water quality monitoring by biologists of the Federal Water Pollution Control Administration from the Division of Pollution Surveillance. Ohio River Basin stations sampled regularly include: Ohio River at Pittsburgh, Pennsylvania; Toronto, Ohio; Addison, Ohio; Huntington, West Virginia; Cincinnati, Ohio; Louisville, Kentucky; Evansville, Indiana; and Cairo, Illinois (a station at Marietta, Ohio was added in 1966); and the Ohio River tributaries, Allegheny River and Monongahela River at Pittsburgh, the Kanawha River at London and Winfield Dam, West Virginia, and the Wabash River at New Harmony, Indiana. In most cases the stations are located upstream from major waste sources at the cities. The data presented are from collections taken in the four-year period from 1963-66. In 1963-64, the primary sampling devices were Ekman and Petersen dredges. In 1965, basket sampler (limestone-filled, artificial substrates) were used to complement the dredge sampling. The macroinvertebrate populations of the Ohio River and the Ohio River tributaries are presented in two tables by organism and by sampling site. (McCann-Battelle)

71-04208

HYTOPLANKTON, SESTON, AND DIS-OLVED ORGANIC CARBON IN THE LITTLE IAMI RIVER AT CINCINNATI, OHIO,
ederal Water Pollution Control Administration, incinnati, Ohio.
or primary bibliographic entry see Field 05A.
71-04209

GUIDE TO THE COMMON DIATOMS AT ATER POLLUTION SURVEILLANCE YSTEM STATIONS,
ederal Water Pollution Control Administration, incinnati, Ohio. Div. of Pollution Surveillance.
or primary bibliographic entry see Field 07C.
71-04210

STUDY OF PHOTOSYNTHESIS IN CLEAR AKE, IOWA,
ederal Water Pollution Control Administration, incinnati, Ohio.
ornelius I. Weber.
wa Academy of Science, Vol 70, p 79-87, 1963. 4 g, 4 tab, 11 ref. AEC Contract AT (11-1)59.

escriptors: *Photosynthesis, *Phytoplankton, Or-nic matter, Fish, Food chain, Dissolved oxygen, eston, Carbon radioisotopes, Carbon, Radioac-vity techniques, Aquatic productivity, Light in-nsity, Iowa.
lentifiers: Clear Lake (Iowa), Illumination, Light nergy, Inorganic carbon.

he oxygen and carbon-24 methods were used to easure photosynthesis in Clear Lake, Iowa during 958 and 1959. Differences in the rates of hotosynthesis at widely separated stations were enerally small. Daily variations in the rate of hotosynthesis were not greater than two-fold. The orrelation between the rate of photosynthesis and he incident illumination was 0.81, and the efficien-y of utilization of incident light energy was 0.72 er cent. The net gain of organic matter at the hytoplankton level during the period May 1 to ovember 1 was equivalent to 3480 pounds of glu-ose per acre. The relationship is shown between hotosynthesis and total incident light energy for lective days from June 3 thru July 17. Daily hotosynthesis curves at one station are given for lective days from April thru July. (McCann-Bat-lle)
71-04212

IMNOLOGICAL FEATURES OF A ORTHERN BROWN-WATER STREAM, WITH PECIAL REFERENCES TO THE LIFE HISTO-IES OF THE AQUATIC INSECTS,
lberta Univ., Edmonton. Dept. of Zoology.
ugh F. Clifford.
he American Midland Naturalist, Vol 82, No 2, p 78-597, October 1969. 8 fig, 5 tab, 38 ref.

escriptors: *Mayfly, *Humic acids, *Water quali-, Limnology, Aquatic insects, Subarctic, Aquatic roductivity, Water temperature, Biomass, ydrogen ion concentration, Dissolved oxygen, hosphates, Color, Turbidity, Stone flies, Diptera, mphipoda, Gastropods, Oliqochaetes.
lentifiers: *Bigoray River (Alberta), *Fluvic acid, eptophlebia cupida, Baetis tricaudatus, Trichop-ra, Hemiptera, Megaloptera, Anisoptera, Coleop-ra, Hiaudinea.

quatic invertebrates of a northern brown-water ream of west central Alberta, the Bigoray River, ere studied for 2 years. The stream drains exten-ve muskeg terrain, but the pH of the water is al-ays on the alkaline side; water temperatures are ear 0C for 6 months of the year, and the stream is ompletely ice-covered for 5 months; there is rogressively less flow during the winter months. uring dry winters, water freezes into the sub-rate, causing considerable mortality to riffle-in-abiting insects. The stream supports a large and iverse mayfly (Ephemeroptera) fauna with Lep-tophlebia cupida (Say) and Baetis tricaudatus Dodds accounting for over 50% of the total yearly fauna by numbers and also volume biomass. Life history data are presented for 11 aquatic invertebrates. Compared to faunas of other streams, the Bigoray River has the following pertinent features: (1) a fauna with a restricted emergence period; (2) a short period (5 months) of seasonal succession and a long period (7 months) when the fauna changes very little; (3) various seasonal growth patterns exhibited by individual species, but the fauna as a whole grow most intensely in autumn; (4) a relatively large number of temporary (or summer) may fly species and (5) a winter species fauna having extensive delayed hatching. (McCann-Battelle)
W71-04215

5D. Waste Treatment Processes

SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
Masonite Corp., Chicago, Ill.
Ward C. Parsons.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, July 1968, p 602-607. 4 fig.

Descriptors: *Dissolved oxygen, *Biochemical oxygen demand, *Chemical oxygen demand, *Hydrogen ion concentration, *Soil types, *Climatic data, Sprinkler, Irrigation, Sprays, Waste treatment, Soil-water-plant relationships, Waste water treatment.
Identifiers: Spray irrigation, Hardboard, Hexosans, Glucose, Manose, Galactose, Pentosans, Lignin, Organic acids, Hemicellulose degradation products.

There have been many false notions concerning spray irrigation such as likening this process to a gigantic sand filter. Purification of waste by this method is the direct result of two basic natural phenomena; natural biological reduction and adsorption. Experiments were conducted using the waste water effluent from the production of hardboard to determine the feasibility of using this process in the treatment of waste water. There are advantages and disadvantages to using spray irrigation. The advantages of spray irrigation are: (1) it is simple to operate, (2) operating costs are moderate, and (3) it operates well in dry climates and dry weather. However, there are disadvantages, such as: (1) vast acreage is required, (2) knowledge of subsurface conditions is required, (3) rainy weather causes drainage problems, (4) high power costs, (5) possible salt concentrations, and (6) supersaturation. The author cautions the engineers to consider all the parameters involved in spray irrigation prior to selecting this method for treatment of waste. (Ellis-Texas)
W71-03886

WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
New Mexico Bureau of Mines and Mineral Resources.
Roshan B. Bhapper, John H. Fair, and John R. Wright.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, July 1968, p 575-592. 4 fig, 4 tab.

Descriptors: *Flotation, *Filtration, *Groundwater movement, *Mine wastes, Water pollution sources, Excavation, *Molybdenum, New Mexico, Waste water treatment, Mine drainage, Acid mine water.
Identifiers: *Questa Mine (N Mex), Molybdenite, Cyanide, Complexing Agents, Tailings Pond.

The problem of molybdenum mining and its resultant processes are presented here. A brief resume of the history of the Questa Mine, its geologic setting, mining and milling operations, and the milling chemistry of molybdenum is included. Sportsmen and conservationists became alarmed at observed tailings, frothing of the water, and fish kills as a result of mining and processing. Public opinion became quite strong when it was found that 'cyanide' was used in the process. Studies of line boxes and aquariums indicated the toxicity of the waste. Analysis of the Red River and causes of fish deaths were conducted by Federal agencies. Changes in the milling chemistry helped resolve the problems that the mining industry encountered. (Ellis-Texas)
W71-03888

DESIGN OF PLUGFLOW POST AERATION BASIN,
Rex Chainbelt Inc., Milwaukee, Wis.
Richard A. Kormanik.
Journal Water Pollution Control Federation, Vol 42, No 11, p 1922-1931, November 1970. 5 fig, 2 ref.

Descriptors: *Mathematical models, *Reareration, *Dissolved oxygen, Mechanical control, Design, Mixing, Diffusion, Aeration, Waste water treatment.
Identifiers: *Post aeration basins, Surface aerators, Final effluent, Plug flow, Aerator spacing, Oxygen transfer coefficient, Diffused aeration, Detention time.

A mathematical design procedure has been developed for use in designing plug flow post-aeration basins. These basins raise the dissolved oxygen level of final effluent from a waste treatment plant up to levels acceptable to the appropriate regulatory agency. The mathematical formulas are derived in a step-by-step approach. The advantage to the mixing basin is that the dissolved oxygen level may be closely controlled, whereas in a flume or spillway device there is no means of control. Studies revealed that when no detectable oxygen utilization rate was present, then detention time ceased to be a controlling parameter in the re-aeration system. (Lowry-Texas)
W71-03889

FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.

Engineering-New-Record, p 24-25, August 13, 1970.

Descriptors: *Sewage treatment, *Gamma rays, *Nuclear energy, *Water reuse, *Tertiary treatment, Chlorine, Virus, Diatomaceous earth, Activated carbon, Cobalt, Detergents, Pesticides, Waste water treatment, Sewage effluents.
Identifiers: Irradiation, Extended aeration package plant.

Energy Systems, Inc. of Melbourne, Florida, has designed, built, and operates a small treatment plant in Palmdale, Florida which uses nuclear irradiation to kill viruses, break down 96% of all detergents, break down some pesticides, kill 100% of fecal coliform, and 99.99% of general coliform. DO is generally around 6 ppm and BOD is less than 15 ppm. This system utilizes an extended aeration package plant followed by six slim rods of cobalt 60 housed in 14x14x9 ft. reinforced concrete structure. Effluent from the irradiator is of such quality that it could be used for irrigation while passing this effluent through a diatomaceous earth filter would meet FWQA standards for discharge into a stream. If the waste is to be recycled the effluent from the diatomaceous earth filter must be passed through carbon filters. There is no detection of radiation emission outside of the building nor is there any trace of radioactivity in the effluent. Some discussion of the cost of installation and operation is also included. (Ellis-Texas)
W71-03890

ANAEROBIC DIGESTION FAILURES,
Bergen County Sewer Authority, Little Ferry, N.J.
Stanley A. Peterson, and Herman R. Zablatzky.
Journal Water Pollution Control Federation, Vol 40, No 4, p 581-585, April 1968. 2 fig, 5 tab, 3 ref.

Descriptors: *Anaerobic digestion, *Alkalinity, Lagoons, Hydrogen ion concentration, Waste water treatment, Sludge, *Sludge digestion, Digestion (Decomposition).
Identifiers: Isolation, *Ammonium alkalinity, Thickeners, Volatile acids, Gas production, Sodium hydroxide, Potassium hydroxide, Calcium oxide, Gas agitation.

Two separate incidents of digester failure are discussed, along with the materials and methods used to help them recover. Parameters of pH, alkalinity, CO2 content, volatile acids content, and gas production were continuously monitored and that data is presented in graphical form. Underconcentration of feed sludge may lead to failure by the depletion of alkaline buffering materials. Over concentration of feed sludge allows buildup of ammonium alkalinity to toxic levels. One of the essentials of good digester maintenance is early diagnosis of problems through close observance of the major parameters. Ideal sludge concentration varies from plant to plant and must be determined by the individual operator. (Lowry-Texas)
W71-03891

PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
N. L. Nemerow, and R. Armstrong.
Industrial Waste Conference (22nd), Purdue University, p 593-601, 1968. 5 fig, 2 tab, 2 ref.

Descriptors: *Alkaline water, *Biochemical oxidation demand, *Chromium, *Sulfur compounds, Biological treatment, Screens, Settling basins, Pumps, Filters, Activated sludge, Aeration, Digestion, Waste water treatment, New York.
Identifiers: *Tannery wastes, *Sulfites, Cayadutta Creek, Gloversville (NY), Dortmund settling tanks, Glue manufacturing, Textile dying, Roughing filters, Aeration tanks.

A prototype plant was constructed in 1965 at the existing Gloversville waste water treatment plant to treat the combined waste from tanneries, textile dying plants, and municipalities. These wastes were effectively treated in a two stage biological plant using the activated sludge process preceded by a roughing filter. Biochemical Oxygen Demand reductions were obtained in the range of 80-90 percent, there was no odor problem, and varying the pH did not appear to affect the treatment. Color removal was obtained 100 percent of the time, however, complete color removal was not obtained all the time. Two sets of tests were run, the first without polyelectrolytes, and the second, with polyelectrolytes. Polyelectrolytes enhanced the Biochemical Oxygen Demand removal and suspended solids removal. (Ellis-Texas)
W71-03892

COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
Technicomp, Inc., Great Neck, N.Y.
James J. DeGroat, Bruce A. Pomeroy, and Robert E. Hagadorn.
Public Works, Vol 101, No 11, p 51-53, November 1970.

Descriptors: *Sewage treatment, *Computer simulation, *Mathematical models, Design, Automation, Waste treatment, Programming languages, Specifications, Design, Waste water treatment.
Identifiers: Computerized drafting machines, Fortran IV, IBM 1130.

Technicomp Corporation, under contract to the Federal Water Quality Administration, has developed a program which performs all design calculations and specifications not requiring engineering judgement. Size and weight criteria were established, and information on all available equipment fed directly into the program. The program is written in Fortran IV, and especially for the IBM 1130 computer which is common to many consulting engineering offices. Output is from a UDM drafting machine. It includes not only the drawings but all specifications as to wall thicknesses, pipe diameters, flows, valving, and equipment selected. The entire process requires a minimum of 2 weeks time of the sanitary engineering, and the computer programmer. This process presently required, depending on the manpower available, up to a year or more. Detailed cost figures are not available but estimates indicate the process to be substantially cheaper. Also, slight modification would allow applicability to many different process industries. (Lowry-Texas)
W71-03893

MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
Deering Milliken Research Corp., Spartanburg, S.C.; and Clemson Univ., S.C.
Eugene P. Willimon, Jr., and John F. Andrews.
Industrial Waste Conference (22nd), May 2, 3, 4, 1967, Purdue University, Vol L II, No 3, p 645-660, July 1968. 12 fig.

Descriptors: *Waste treatment, *Microorganisms, *Chemical oxygen demand, *Hydrogen ion concentration, Retention, Volatility, Anaerobic bacteria, Anaerobic conditions, Anaerobic digestion, Aerobic conditions, Aerobic treatment, Aeration, Methane, Waste water treatment.
Identifiers: Multi-stage biological processes, *Multi-stage digestion, Removal rate, Retention time, Volatile suspended solids, Volatile acids.

The authors conducted experiments to show the value of using more than one stage of waste treatment. By using a two stage system, the reactions could be separated and optimized independently of each other. One of the examples shown is the removal of nitrogen from wastes as proposed by Wuhrmann. In this process all of the nitrogen compounds are oxidized under aerobic conditions to NO2 and NO3 in the first stage, and under anaerobic conditions in the second stage where the oxides are reduced by denitrifying bacteria to the gaseous products of N2 and N2O which readily separates from the liquid phase of the waste. The study conducted by the authors consisted of two parts: (1) a series of single stage experiments designed to explore the effects of pH and aeration rate on the effluent composition at low retention times; and (2) a series of multi-stage experiments designed to compare a multi-stage system with a single-stage system using pH control in both systems and limited aeration in the first stage of the multi-stage system. Many analytical tests were conducted and the information on the improved Chemical Oxygen Demand reductions and removal rates for the two stage system was typical of the advantages observed for the multi-stage process. The definite effect of pH illustrates the need for closer control over environmental parameters on present and future processes. (Ellis-Texas)
W71-03894

A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
Johannesburg City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 05G.
W71-03895

DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
Farmers Home Administration, Champaign, Ill.
David H. Stoltenberg.
Public Works, Vol 101, No 9, p 103-106, September 1970. 4 fig, 3 tab, 17 ref.

Descriptors: *Oxidation lagoons, *Stabilization, *Algae, Aerobic treatment, Bacteria, Municipal wastes, Biochemical oxygen demand, Waste water treatment.
Identifiers: Depth, Slope, *BOD loading, *Waste stabilization.

There are several important factors involved in waste stabilization using lagoons. The fact that oxygen is produced by algae during the day and consumed by algae at night is presented as a critical factor in lagoon design and maintenance. The variance of allowable biochemical oxygen demand loading with geographical location is also discussed. Construction costs are also presented. Estimates range from $11 to $18 per capita for installations serving 1000 people, and from $30 to $36 per capita for installations serving 100 people. Operation and maintenance costs are estimated to be one-fourth, or one-fifth of the cost for conventional waste treatment. (Lowry-Texas)
W71-03896

DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
Maryland Univ., College Park. Dept. of Civil Engineering.
John T. Cookson, Jr.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2124-2134, December 1970. 7 fig, 1 tab, 10 ref.

Descriptors: *Activated carbon, *Absorption, *Liquid wastes, *Sewage treatment, *Water purification, Tertiary treatment, Solids contact process, Hydrogen ion concentration, Mass transfer, Boundary processes, Boundary layer, Reynold's number, Waste water treatment.
Identifiers: Attachment, *Transport, Langmuir Isotherm, Von Karmon integral relation, Colburn factor, Sherwood Number, Schmidt Number.

Activated carbon beds offer an effective means of removing organics that exist in very low concentrations. In this process, variables of importance are flow rate, bed height, void fraction, available adsorption area per bed volume, bed particle, size, and the past history of the adsorption bed. An evaluation of a mathematical model is conducted. This model utilizes the theory of mass transfer, based on the thin boundary layer solution of the diffusion equation and the adsorption equilibrium distribution of solute between the stationary and moving phases. The validity of the model is examined by studies on the removal of the virus bacteriophage T4 in packed beds of activated carbon. Virus adsorption on activated carbon can be correlated by the Langmuir isotherm and the validity of the adsorption model to predict the capacity and breakthrough concentration is illustrated. Experimental mass transfer coefficients gave excellent correlation with the Reynold's Number as predicted by Pfeffer and Happel's model which extends mass transfer theory to include multiparticle systems. A simplified design procedure is included. (Ellis-Texas)
W71-03897

MINE WASTE WATER PROBLEMS IN EUROPE,
Pennsylvania Dept. of Mines and Mineral Industries, Harrisburg.
David R. Maneval.
Industrial Waste Conference (22nd), May 2, 3, 4, 1967, Purdue University, July 1968, p 608-619. 9 fig.

Descriptors: *Mine acids, *Sedimentation, *Carbon dioxide, *Hydrogen ion concentration, Water pollution, Waste treatment, Watersheds, Filtration coagulants, Coal mine wastes, Water purification, Acidic water, Water pollution control, Waste water treatment.
Identifiers: United Kingdom, Netherlands, West Germany, Belgium, Back flushing, Emscher River Basin (W Ger).

This is an analysis of how Europeans are combatting the water pollution problems caused by mining. Europeans are realizing the need for community effort and are relying increasingly on river basin authorities and river boards. Probably the most interesting method is used in the Emscher River Basin. The Emschergenossenschaft was established in 1004 with the role of regulating the

ying waste waters. It is the only agency of its to provide waste treatment for the entire river . Europeans have found that it is of great im-ance and benefit to conduct a well coordinated arch program in mine drainage and preparation it effluents. Most European countries are ahead e United States in research and the abatement ollution caused by coal processing plants. ral methods of waste treatment are included in article indicating how various European coun- have treated the effluent from mines and aration plants. (Ellis-Texas)
-03898

STE CONTROL HIGHLIGHTS PLANT IGN.

ronmental Science and Technology, Vol 4, No 898-900, November 1970.

criptors: *Re-cycle, *Recovery, Concentration, egation, Fermentation, Biochemical, Industrial es, Monitoring, Cooling, Environmental con- *Water reuse, Waste water treatment, Indi- Treatment facilities.

tifiers: Spent fermentation broth, Dilute nical wastes, Concentrated chemical wastes, tery process wastes, Clinton (Ind).

illy and Company has designed and built a new entation plant at Clinton, Indiana. This plant is gned for total environmental security, re-less of cost involved. Any recoverable chemi- will be recovered regardless of cost. All waste ums will be treated individually for better treat-t. Less than 2,500 lb. BOD per day will enter Wabash River in a waste stream of no more .1% of the mean river flow. 90% of total water in the plant in all processes will be recycled. If -up problems involved can be surmounted, this t should be the forerunner of many new plants gned to protect the environment, not only in biochemical field, but in all industries. (Lowry-as)
-03899

EMICAL PRECIPITATION OF PHOSPHATE THIN A HIGH RATE BIO OXIDATION TEM I. SYNTHETIC SEWAGE STUDIES,
nsylvania State Univ., University Park. Dept. of l Engineering.
A. Eberhardt, and J. B. Nesbitt.
strial Waste Conference (22nd), May 2, 3, 4, 7, Purdue University, Vol 52, No 3, July 1968, 0-119. 6 fig, 7 tab, 32 ref.

criptors: *Chemical precipitation, *Phosphate, tivated sludge, Pilot plant, Biodegradation, mical treatment, Biological treatment, Waste r treatment, Sewage treatment.
tifiers: Bio-chem process, Combined chemical-ogical treatment, Aluminum-Phosphorus ratio, osphorus removal, Multi-stage processes.

Bio Chem process is a combined chemical-logical treatment process capable of effecting phosphorus residuals while at the same time lucing a low effluent Biochemical Oxygen De-d. Using only three system components... a bined aeration, chemical mixing, and coagula-basin having a 2.7 hour detention time, a clari- and filtration... total phosphorus residuals and 05 removals averaged, respectively, .19 milli-ns phosphorus as phosphate per liter and 94.8% a 35 day run. This process is compared with r processes used when both phosphorus and hemical oxygen demand in the effluent must be The Bio-chem process is shown to be the most nomical without sacrificing the efficiency of the ogical treatment operation. (Lowry-Texas)
1-03900

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
Boyle Engineering, Las Vegas, Nev.; and Cornell, Howland, Hayes, and Merryfield, Las Vegas, Nev.

Report to the Board of Commissioners of Clark County, Nevada, February 1969. 185 p, 25 fig, 45 tab, 90 ref. C 5021.0, 87-0922-00-00.

Descriptors: *Water quality control, *Urbanization, *Water pollution control, *Water resources development, *Waste water treatment, *Planning, Hoover Dam, Colorado River, Nevada.
Identifiers: *Las Vegas Valley, *Lake Mead, Las Vegas Wash.

A long-range water resource management program was developed for optimization of the beneficial uses of the total water resources in the Las Vegas Valley and the protection of these resources for future generations. Phase I discusses the work necessary to isolate and define the overall problem and make recommendations for selection of a management agency to implement the program. The study area includes about 2,200 square miles in the Las Vegas Valley tributary to the Las Vegas Wash into Lake Mead. The following recommendations are made: (1) That Phase II be authorized immediately to expedite the detailed program formulation and enable full activation of initial operational capability by mid-1972; (2) That the Las Vegas Valley Water District be designated as the agency responsible for the management of water resources and water quality control. It is further recommended that this decision be made soon in order to permit the District to initiate constructive discussion with other agencies. Operational and financial decisions may, in that way, be incorporated into the Phase II program; (3) That the Las Vegas Valley Water District Act should be revised to give the District specific authority to collect, treat, and dispose of sewage, waste and storm waters. (See also W71-03902) (Poertner)
W71-03901

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
Boyle Engineering, Las Vegas, Nev.; and Cornell, Howland, Hayes, and Merryfield, Las Vegas, Nev.

Report to the Board of Commissioners of Clark County, Nevada, December 1969. 146 p, 16 fig, 46 tab, 41 ref. C 5021.0, 87-0922-00-00.

Descriptors: *Water quality control, *Tertiary treatment, *Urbanization, *Waste water treatment, *Water pollution control, Hoover Dam, Colorado River, Groundwater recharge, Reservoir evaporation, Hydroelectric power, Irrigation, Desalination, Nevada.
Identifiers: *Las Vegas Valley, *Lake Mead, Las Vegas Wash.

A comprehensive water quality control program is described for the Las Vegas Drainage Basin. A summary of the conclusions and recommendations reached in the Phase I report is included. Volume II presents conclusions and recommendations. A number of possible combinations of treatment and/or disposal techniques to meet the needs of the Las Vegas Valley area have been studied. These include: in-valley irrigation; exportation to five different hydrogeologically isolated areas; combined irrigation and exportation; groundwater recharge; an area-wide collection, treatment and disposal system terminating at the Colorado River below Hoover Dam; and complete treatment to meet effluent standards for Lake Mead disposal. Similarly, a variety of treatment processes were investigated to meet the needs of the various overall alternates. These processes range from no additional treatment through simple filtration to sophisticated desalinization processes. In-depth comparisons were made on four basic alternate plans as follows: (1) Groundwater basin recharge, (2) Exportation to Eldorado and Dry Lake Valleys, (3) Las Vegas Valley waste water collection and treatment system, and (4) Complete treatment. The Las Vegas Valley waste water collection and treatment system is shown to provide the most economical solution to the overall problems of waste water treatment and disposal of any of the alternates studied. This plan envisions collection of secondary effluents and industrial waste waters, tertiary treatment and discharge below Hoover Dam. (See also W71-03901) (Poertner)
W71-03902

SANTEE PROJECT CONTINUES TO SHOW THE WAY,
Santee County Water District, Calif.
E. W. Houser.
Water and Wastes Engineering, May 1970. 5 p, 2 fig.

Descriptors: *Tertiary treatment, *Water reuse, *Municipal wastes, *Sewage treatment, *Waste water treatment, Cities, Urbanization, Reclaimed water, Water shortage, Water conservation, Recreation, Oxidation lagoons, Anaerobic digestion, Electrodialysis, Ion exchange, California.
Identifiers: *Santee County Water District (Calif).

A historical account is given of the Santee County Water District's successful pioneering efforts to solve waste water disposal problems and, at the same time, to make better use of its increasingly expensive water supplies through the development of better water management practices. This approach necessitated the development of a waste water reclamation system capable of returning municipal waste water to a level of quality that made possible reuse for purposes higher than limited irrigation. It was also necessary to break the 'regulation barrier' that had previously limited the use of sewage treatment plant effluents to golf course irrigation and the irrigation of crops not directly consumed by people. A tertiary treatment plant has been placed in service and its effluent is transported to adjacent recreation lakes. The biological process reduces nitrates to gaseous nitrogen through anaerobiosis of the activated sludge. Phosphates are then removed by chemical additions, flocculation, and settling. Alum and lime are the primary chemicals used. The next stage is filtration through dual media filters to produce an effluent with less than 1.0 mg/liter suspended solids. The water is chlorinated before release to the lakes. Future plans are to intercept a portion of the flow, after filtration, for demineralization and passage through deep carbon filters. Half of this flow will then pass through an ion-exchange unit and half through an electrodialysis unit. The total dissolved solids of this effluent will be below that of the raw drinking water supplied to the Santee population. (Poertner)
W71-03904

WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 03A.
W71-03912

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
Aerojet-General Corp., El Monte, Calif.
R. M. Roberts, and L. E. Gressingh.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price: $1.50. Office of Saline Water Research and Development Progress Report No. 579, July 1970. 115 p, 21 tab, 20 fig, 41 ref, append. OSW Contract 14-01-0001-1775.

Descriptors: *Water reuse, *Irrigation water, *Return flow, Desalination, Boron, Osmosis, *Reverse osmosis, Waste water treatment.
Identifiers: *Boron removal, Irrigation return water.

The objective of this program has been to investigate and develop methods that are economically feasible for reducing to nonphytotoxic levels the boron content of irrigation return waters that have been renovated by reverse osmosis treatment. In consideration of economic and technical factors, only one method among the conventional and novel techniques investigated offers immediate promise of successful application. This method is based on a discovered process modification in which Amberlite XE-243, a commercial (Rohm and Haas Co.) boron complexing resin, is used. A small (3 KGAL/day) system has been designed which will permit the field evaluation of this process in the deboronation of permeate from a reverse osmosis system. (Wheeler-Office of Saline Water)
W71-03914

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
Powell (Sheppard T.) and Associates, Baltimore, Md.
For primary bibliographic entry see Field 03A.
W71-03916

PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
Raymond P. Canale.
Biotechnology and Bioengineering, Vol 11, No 5, p 887-907. 9 fig, 25 ref.

Descriptors: *Bacteria, *Protozoa, *Fungi, *Rotifers, Model studies, Waste water treatment, Nutrients, Microorganisms, Activated sludge, Sludge.
Identifiers: *Predator-Prey relationship.

Three differential equations describe the relationships between soluble organic nutrients, bacteria, and protozoa in a continuously fed, stirred tank biological reactor. The system is seen to oscillate widely as differing amounts of each of the three quantities are either synthesized or destroyed. The differential equations were analyzed to characterize the possible types of solutions which could be obtained. A limit cycle solution was obtained for some values of the system parameters. Simplifying assumptions made initially need to be tested by further experimental work. (Lowry-Texas)
W71-04070

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Robert L. Bunch, and M. B. Ettinger.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 393-396, July 1968. 1 fig, 14 ref.

Descriptors: *Algae, *Biodegradation, *Phosphates, *Eutrophication, Nutrients, Nitrogen, Waste water treatment, Phosphorous, Runoff, Domestic wastes, Detergents, Industrial wastes, *Chelation.
Identifiers: Urban runoff.

Eutrophication will be an increasingly important problem in the future as more waters are impounded and reused. Consideration should be given not only to improving methods of nutrient removal from sewage influents, but also to finding acceptable substitutes for phosphates in industrial processes and detergent formulations. Private industry can make a contribution by developing economically practical materials which will be converted into innocuous products at a rate sufficiently rapid to prevent significant accumulation of pollutants. It appears that biodegradable chelating agents may be considered as a partial substitute for phosphates in certain types of detergent formulations. The relationship between the structure of chelating agents and the loss of chelating ability due to biological action remains to be answered. Results on compounds now under study should give a better understanding of the type of chelating compounds that would minimize environmental contamination. So far, only compounds containing only ore nitrogen molecule have show biodegradability. It does not seem desirable to use nonbiodegradable chelating agents that strongly complex heavy metals unless it has been demonstrated that they do not interfere with waste treatment, coagulation, water softening, calcium metabolism of man, or convey metals into the drinking water. (Ellis-Texas)
W71-04072

ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
Texas Univ., Austin. Center for Research in Water Resources.
Wesley W. Eckenfelder, and Davis L. Ford.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 279-291, July 1968.

Descriptors: *Activated sludge, *Aeration, *Aerated lagoons, *Oxygen requirements, Transfer, Energy dissipation, Extended aeration, Chemical wastes, Waste water treatment, Industrial wastes, Surfactants.
Identifiers: *Gas transfer, *Oxygen transfer, Entrainment, Refinery wastes, Petrochemical wastes, Liquid film coefficient.

In recent years mechanical surface aerators have become increasingly popular for applications in aerated lagoons and the activated sludge process. When developing aeration design and process application there are several factors which must be considered. These are: (a) the oxygenation efficiency under specified aeration conditions, (b) mixing conditions in the aeration basin, and (c) the oxygen transfer in the aeration liquid relative to water. It has been shown that the oxygenation efficiency of surface aeration units varies with the volume of liquid under aeration. The coefficient alpha can be defined as the ratio of the liquid film coefficients of the waste to that of water. R value for alpha must be used in the design of a surface aeration system and present capabilities for experimentally determining this value is very difficult. Unless more specific information on the prototype aeration unit is available, the minimum alpha value computed from the study should be used for conservative design. Basic principles in the design of surface aeration are included with an example problem. (Ellis-Texas)
W71-04073

THE ANAEROBIC FILTER FOR WASTE TREATMENT,
Stanford Univ., Calif. Dept. of Civil Engineering.
James C. Young, and Perry L. McCarty.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 559-574, July 1968. 7 fig, 5 tab, 9 ref.

Descriptors: *Filtration, *Anaerobic conditions, *Biodegradation, *Anaerobic bacteria, Microorganisms, Sewage bacteria, Methane, Chemical oxygen demand, Biological treatment, Waste treatment, Waste water treatment.
Identifiers: *Biological solids production, Effluent quality, Anaerobic filter.

Experiments found that low strength soluble wastes can be treated anaerobically by upflow filtering through rocks. Anaerobic microorganisms collect in the void spaces so that the waste comes in contact with a large biological mass causing a high degree of treatment and an effluent essentially free of biological solids. The advantages of this type of filter are: (1) it is usually suited for treatment of soluble wastes, (2) no recycle is nedded, (3) biological solids remain in the filter, therefore there is little sludge wasting and (4) no addition of heat is required. Aeration or other similar methods can e fectively remove any remaining biochemical o ygen demand and sulfides in treated effluer Power requirements for filter operation are almo nonexistant due to the low head loss through t filter although methane produced from the deco position of wastes can be used for power supply this is necessary. Low maintenance of this systen probable and sludge handling and waste dispos are minimized. (Ellis-Texas)
W71-04075

HIGH-RATE BIOFILTRATION: PAST AND F TURE,
Imperial Chemical Industries Ltd., Brixham (E gland). Brixham Research Lab.
M. W. Askew.
Water Pollution Control, Vol 69, No 4, p 445-45 1970. 1 fig, 5 tab, 10 ref.

Descriptors: *Filtration, *Waste water treatmer Sewage treatment, Water pollution treatmer Biochemical oxygen demand, Dewatering, Indust al wastes, Sludge disposal, E. Coli.
Identifiers: *Biofiltration, *Polyvinyl chlorid *Plastics media, Streptococcus faecalis.

The use of filters in waste water treatment is n new and the development of plastic packings f high-rate biofiltration has increased the efficien and desirability of this system for use where co ventional filters or the activated sludge proce have been inappropriate. Polyvinyl chloride seer to be the most applicable type of synthetic polym presently available but with the increase of inter in this process there undoubtedly will be a bett cheaper or more efficient filter in the futu Probably future uses for biofiltration are part treatment of sewage prior to discharge into coas waters, and in industry. Public opinion is calling f some kind of treatment and biofiltration offers comparatively economical means of providing while the benefits of high rate biofiltration wou be a marked reduction in the pathogenic indicat organism counts, and a reduction in the Biochen cal Oxygen Demand. Industry may consider t process in water reuse especially where the ind try uses a large volume of water. (Lowry-Texas)
W71-04076

THE EFFECT OF SHORT-TERM TEMPER TURE VARIATIONS ON METHANE PRODU TION,
Texas Univ., Austin. Environmental Health E gineering. Research Lab.
Richard E. Speece, and Jan A. Kem.
Journal Water Pollution Control Federation, V 42, No 11, p 1990-1997, November 1970. 8 fig tab, 9 ref.

Descriptors: *Sludge digestion, *Anaerob digestion, Waste water treatment, Sludg Digestion (Decomposition), *Temperatu *Methane.
Identifiers: Methane production, Volatile acids.

Laboratory experiments were conducted usi acetate fed into a well-digested mesophilic slud and varying the temperature for a period of 15- minutes. This sludge was also tested at 35C a 45C to observe the relative response of acid for ing and methane forming organisms. It was fou that raising the temperature increased the activi of the methane formers and also decreased the i tial amount of volatile acids present. The varying temperatures below 20C resulted in negligi methane production but there was no resultant r tardation of gas production after restoring the te perature to its normal state inside the digester. (E lis-Texas)
W71-04077

RESPIRATORY RELATIONSHIPS OF A SY BIOTIC ALGAL-BACTERIAL CULTURE FO WASTE WATER NUTRIENT REMOVAL,
Ohio State Univ., Columbus. Dept. of Civil E gineering.

Humenik, and G. P. Hanna, Jr.
echnology and Bioengineering, Vol 12, p 541-
1970. 8 fig, 3 tab, 17 ref.

riptors: *Symbiosis, *Algae, *Bacteria,
piration, Activated sludge, Waste water treat-
t, Nutirients, Aerobic conditions, Aeration,
obiology, Biomass, Chlorella.
tifiers: *Nutrient removal, Oxygen decline,
iratory rates, Photosynthetic oxygenation, Ac-
ed algae.

arch was conducted to investigate the respira-
relationships of a mixed algal-bacterial culture
he effect of its natural ecological associations
ne stabilization of a domestic waste water. In
r to do this the authors developed a continuous
iotic algal-bacterial system of a mixed
rella-activated sludge culture which would ef-
ntly remove nutrients from waste water under
ic conditions and without additional aeration.
harvesting of excess biomass was conducted
rovide stable relative biological populations
a dissolved oxygen concentration of approxi-
ly 2 milligrams per liter was maintained
ghout steady state operations. To predict
ratory rates, photosynthetic oxygenation and
ly-state oxygen concentrations oxygen decline
were fitted to mathematical models. The
ratory and physiological relationships in-
ed that the carbon dioxide-oxygen balance
be a primary control governing the steady-
operation of a symbiotic algal-bacterial cul-
Microscopic examinations showed that bac-
were attached to algal cells and the Chlorella
integrally enmeshed within the bacterial mix
h allowed this algal-bacterial floc to settle
rapidly and yield a clear supernatant. (Ellis-
s)
-04079

TE WATER TREATMENT FACILITIES AT NS HARBOR,
elhem Steel Corp., Chesterton, Ind. Burns
or Plant.
Leidner, and R. Nebolsine.
strial Waste Conference, 22nd, Purdue
ersity, Vol 52, No 3, p 631-644, May 1967. 16

riptors: *Waste water treatment, Water quali-
Water requirements, Waste water disposal,
culation, Lagoons, Dams, Oil wastes,
ogen ion concentration, Biochemical oxygen
nd, Activated sludge, *Water demand, Indi-
Water reuse, *Industrial wastes.
ifiers: Burns Harbor, Clarifier.

view is presented of the cost of steel produc-
the water required, and the resultant waste
r treatment. Generally, water consumption in
nodern steel plant varies from 35,000-45,000
ns per ingot on produced. The type of process
ed for production determines the amount of
culation that can be performed which in turn
es variations in the amount of water needed
waste water produced. The water demand has
ssitated construction of a 200 MGD pumping
on. The waste treatment in steel production is
plicated by the fact that integrated steel mills
rally produce seven different types of waste
r that all require different types of treatment.
s Harbor will ultimately require that around
MGD be treated. Although waste treatment in
plants is quite comprehensive, only three
rate waste streams are described in this paper
nuch as these are the facilities completed at
ime. (Lowry-Texas)
-04080

TREATMENT OF TOXIC WASTES,
ock, Hill and Rigby, Birmingham (England).
Chalmers.
er Pollution Control, Vol 69, No 3, p 281-291,
. 2 fig, 8 tab, 28 ref.

riptors: *Toxicity, *Waste treatment, Screen-
Centrifugation, Filtration, *Recovery, Toxins,
Evaporation, Sedimentation, Freezing, Solvent extractions, Ion exchange, Adsorption, Heavy metals, Industrial water, Industrial wastes, Industrial production, Water reuse, *Pre-treatment (Water), Effluents.
Identifiers: Swill waters, Metals recovery.

The author describes many of the chemical and physical treatment processes available and indicates there is much scientific progress in the field of waste treatment. He also indicates that scientific progress in this field will be tremendous in the last quarter of the 20th Century and very few problems in waste treatment will remain unsolved at the end of the century. Industry is applying considerable effort to modifying their processes so that they may reduce their effluent problems. Reduction of the amount of water needed for rinsing operations, recycle and reuse and using water for dual purposes are a few of the methods currently being used. Although there is much progress in waste treatment and industrial modifications much remains to be done in applying common sense to the reduction of water use and effluent problems at their source. (Lowry-Texas)
W71-04082

WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
George R. Alger, C. Robert Baillod, and Henry S. Santeford.
Water and Sewage Works, Vol 117, No 10, p 359-362, October 1970. 5 fig, 3 tab, 5 ref.

Descriptors: *Iron, *Strip mines, *Re-circulated water, *Mine wastes, Waste dumps, Water purification, Settling basins, Ponding, Sedimentation, Waste water treatment, Impoundments, Tertiary treatment.
Identifiers: Lake Superior, Tailings deltas, Alum-coagulation, Tailings slurries.

The increasing scarcity of high-grade iron ore has necessitated the use of lower grade, or less concentrated ore pockets. This ore must then be concentrated to make it economical to process. The production of one tone of concentrate from four tons of crude ore requires from 600 to 6000 gallons of water, depending upon the method used. The waste water from this process contains 70,000 to 500,000 milligrams per liter of suspended solids, 90% of which settles very rapidly. Direct discharge of this waste water into a receiving stream or lake causes tailings deltas to build up. To prevent this, large impoundment basins are created, which allow the suspended solids to settle before the water gets to the receiving stream. Data shows that these systems must be carefully designed in accordance with prevailing weather conditions, and if so designed they will operate satisfactorily. Problems are most likely to occur during spring thaw, at which time alumcoagulation-sedimentation is used as a tertiary treatment measure. (Lowry-Texas)
W71-04083

ECONOMICS OF THERMAL POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
George O. G. Lof, and J. C. Ward.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2102-2116, December 1970. 5 fig, 3 tab, 16 ref.

Descriptors: *Economics, *Water temperature, *Thermal pollution, *Flow, *Cooling towers, Hydroelectric plants, Water cooling, Recirculated water, Specific heat, Cost analysis, Air temperature, Heat ransfer, Interest rate, Water pollution control.
Identifiers: Turbine-generator efficiency.

Approximately 80% of all water used by industry is used for cooling purposes and it has been estimated by the power industry that by 1980 10% of all the freshwater runoff in the U. S. will be used for cooling purposes. The economic consequences of thermal discharge from steam-electric power plants are modest increases in operating costs by the downstream users. Heat discharge prevention by recirculation is discussed. The reasons for recirculation are: (1) insufficient stream flow, (2) economic reasons, and (3) regulation by laws. The cost of cooling water recirculation is composed of: (1) capital costs (installation costs) which are dependent on the water flow required, the prevailing wet bulb temperature, the water temperature change through the tower, and the temperature of water delivery from the cooling tower to the condenser, and (2) operating costs which are dependent on the makeup of the water, chemicals required, and power for fans and pumps. Justification for temperature standards in streams cannot rest solely on the economics of cooling but it also depends on the ecology, aesthetic, and recreational use of the water. (Ellis-Texas)
W71-04084

KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
B. H. Kornegay, and J. F. Andrews.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, p 620-630, July 1968. 8 fig, 7 ref.

Descriptors: *Kinetics, *Trickling filters, *Filtration, Waste water treatment, Sewage treatment, Microorganisms, Mathematical models, Biological treatment.
Identifiers: Fixed-film, *Biological reactors, Substrate utilization, Substrate removal rate, Specific growth rate, Film thickness, Annular reactor.

An experiment was conducted in search of a more rational design procedure for trickling filters. Although the equations presented in this paper can not be construed to serve as mathematical approximations of the process of trickling filtration, the basic principles are the same, and the authors did a theoretical investigation of the kinetics of fixed-film, biological kinetics. Results of this experiment indicated that both dissolved oxygen and substrate utilization reached a steady-state value when the biological film thickness reached 70 microns and greater thickness resulted in no increase in the rate of removal. A theoretical substrate removal curve was developed and compared with the observed results of the completely-mixed, fixed-film reactor. This comparison showed: (1) the rate of removal shows a saturation phenomenon and by increasing the substrate concentration the rate of substrate removal approaches a constant value (2) the effluent concentration is dependent on the influent concentration and (3) the validity of the proposed model is supported by the agreement found between the theoretical curve and observed results. (Ellis-Texas)
W71-04085

BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
Teck Township (Ontario).
B. Davis, and S. Love.
Water and Pollution Control, p 35-37, May 1969. 3 fig.

Descriptors: *Waste water treatment, *Dissolved oxygen, *Biochemical oxygen demand, *Dissolved solids, Chemical oxygen demand, Hydrogen ion concentration, Coagulation, Chemicals, Aeration, Biodegradation, Sewage treatment.
Identifiers: Kirkland Lake, Ontario, Canada, Cyanide, Jar tests, Suspended solids, Total solids, Contact stabilization.

A very dilute municipal waste was observed and tested in studies conducted in Teck Township, Canada. It was found that the waste was not greatly effected by primary treatment so studies were un-

dertaken to establish the most efficient biological treatment process that would effectively treat the weak sewage. The results of the biodegradability study showed that a source of cyanide caused interference with biological systems and chemical coagulation studies were conducted to determine if this waste could be treated by this means. The chemical treatment resulted in improved BOD and suspended solids removals of 60% and 85%, respectively. It was decided to combine a biological system and chemical treatment. Using this combined treatment and adjusting the chemicals so that an optimum treatment was obtained, the BOD removal was 83% and suspended solids removal was 90%. The BOD of the treated effluent was consistently below 24 mg/l. The cost of the chemicals ranged from 2.0-2.5 cents/1000 gallons while retention time was reduced which would result in a reduction in capital costs. (Ellis-Texas)
W71-04086

SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
Syracuse Univ., N.Y. Bioenvironmental Engineering Div.
Frederick W. Hardt, Lenore S. Clesceri, Nelson L. Nemerow, and Donald R. Washington.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2135-2148, December 1970. 11 fig, 5 tab, 17 ref.

Descriptors: *Filtration, *Activated sludge, Biochemical oxygen demand, Microorganisms, Membranes, Filters, Pressure, Hydrogen ion concentration, Chemical oxygen demand, Phosphorus, Respiration, Gels, Solvents, Solutes, *Waste water treatment.
Identifiers: Mixed liquor, Volatile suspended solids, *Ultrafiltration, Ultrafiltrate flux, Total organic carbon, Cell lysis.

An investigation of the feasibility of separating the suspended material from the mixed liquor and recyling this material back to the biological reactor as a means of treating high-BOD wastes was conducted. This involved passing feedwater at an elevated pressure across synthetic membranes where the larger dissolved solids and suspended material are retained by the membrane and recycled back through the activated sludge plant. Analytical methods included daily monitoring of the COD, total and orthophosphates, TOC, MLVSS, SS, inorganic solids, respiration rate, and the molecular size of the dissolved solids in the mixed liquor and the ultrafiltrate. This process showed a 98% COD reduction but had a gradual accumulation of cell degradation products in the biological reactor. The membranes used detained DS of molecular weights greater than 1000 which essentially removes all bacterial solids from the effluent stream. (Ellis-Texas)
W71-04087

METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
J. A. Heidman, D. F. Kincannon, and A. F. Gaudy, Jr.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 661-647, July 1968. 8 fig, 1 tab, 13 ref.

Descriptors: *Activated sludge, *Metabolism, Acclimatization, Waste water treatment, Biological treatment, *Sludge treatment, Microorganisms, Chemical oxygen demand, Biochemical oxygen demand.
Identifiers: *Sodium pentachlorophenol, *Chlorinated hydrocarbons, Oxidative phosphorylation, Shock loadings, Oxygen uptake.

The effect of various concentrations of soidum pentachlorophenol (SPCP) on acclimated and non-acclimated sludges was investigated. Studies have shown that an activated sludge system can, with sufficient acclimation, be operated in the presence of SPCP concentrations up to 250 mg/l without serious retardation of biochemical purification efficiency. Biological solids in systems which were acclimated to SPCP were totally dispersed, and did not flocculate or settle during a one-hour settling period. The results obtained add evidence regarding release of metabolic products during the purification process and although SPCP did not exhibit a BOD, it caused glucose to exhibit a higher BOD during the aeration period. Under shock loading conditions it was seen that fairly small does of SPCP caused impairment of system efficiency. (Ellis-Texas)
W71-04088

CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
Grace (W. R.) and Clarksville, Md.
Jacob Block.
Available from NTIS as PB-196 740, $0.95 in microfiche. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. I 67.13/4: 17010 DHK 08/69 Paper Copy $0.50. Water Pollution Control Research Series 17010 DHK 08/69, August, 1969. 41 p, 5 fig, 12 tab, 6 ref. FWQA Program 17010 DHK Contract 14-12-485.

Descriptors: *Phosphates, *Waste water Treatment, *Aluminum, Iron, Effluents, Aluminum alloys, Chemical reactions, *Iron exchange.
Identifiers: *Phosphate Removal, *Vermiculities, Alumina.

The objective of the study was to prepare a chemically treated vermiculite with a high phosphate capacity that could be economically regenerated. Many aluminum vermiculites were prepared and tested for phosphate removal. 10 mg PO4/gram of treated vermiculite was the maximum capacity obtained. Highest phosphate capacities were obtained with materials prepared at relatively low pH (3.0) and dilute aluminum solutions (0.1-0.05M). Experimental results showed hydroxylated aluminum vermiculite is inactive towards phosphate ion. The mole ratio of phosphate adsorbed to exchanged aluminum seemed to approach 0.33, or an exchange capacity of 13.7 mg PO4/gm. The most successful regeneration scheme was one in which a dilute sulfuric acid solution containing a small amount of Al sub 2 (SO sub 4) sub 3 was used as a regenerant. Addition of the Al sub 2 (SO sub 4) sub 3 prevented the loss of aluminum from the vermiculite. No significant differences in capacity were found between thermally and chemically exfoliated vermiculite. Vermiculites containing cations other than Al were also prepared. These included Fe (III), Fe (II), La (III), and Cu (II). None appeared more promising than Al-vermiculite. The adsorption isotherm of aluminum-vermiculite was obtained, and the data were found to fit both the Langmuir and Freundlich plots. (Selby-Texas)
W71-04107

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
Gulf General Atomic, San Diego, Calif.
A. S. Douglas, M. Tagami, and C. E. Milstead.
Copy available from Sup Doc as $0.65; microfiche from NTIS as PB-197 448, $0.95. Water Pollution Control Research Series ORD-17040-EFO-06/70, June 1970. 64 p, 22 tab, 6 fig, 17 ref. FWQA Program 17040-EFO.

Descriptors: *Reverse osmosis, Semipermeable membranes, Demineralization, Membrane processes, *Osmosis, Tertiary treatment, *Waste water treatment, Water pollution control, *Water reuse, *Membranes, Sewage effluents.
Identifiers: Asymmetric membranes, Flux, Porous supports, Rejection.

An experimental program was carried out to evaluate potential reverse osmosis membranes for the tertiary treatment of secondary sewage efflue
The evaluation program consisted of both dir
osmosis and reverse osmosis tests on various me
branes using both single solutes and secondary
fluent. The types of membranes tested were pol
rethane latices, cellulose diacetate, cellulose 2
acetate, polyvinyl-pyrrolidone (PVP)-polyi
cyanate interpolymers, and polyelectrolytes. T
cellulose diacetate, polyurethane latices, and P
membranes were not suitable for waste water tre
ment. Although rejection of most solutes by P
membranes was quite good for dense, homoge
ous membranes, high-flux, asymmetric membra
had poor rejection characteristics. Very-high-f
membranes were prepared from polyacrylic a
cast onto cellulose nitrate, cellulose nitrate-cel
lose acetate, and polysulfone porous suppo
While NaCl rejection of over 80% was obtained
fluxes of less than 20 gal/ft sq-day at 600 psi,
creased flux was obtained only at the expense
good rejection. The best combination of high f
and rejection was obtained with asymmetric cel
lose 2.5-acetate membranes heat-treated in wa
at 55 to 70C.
W71-04185

**ENGINEERING FEASIBILITY DEMONSTR
TION STUDY FOR MUSKEGON COUNT
MICHIGAN, WASTE WATER TREATMENT-I
RIGATION SYSTEM.**
Muskegon County Board, Mich. Dept. of Pub
Works.

Available from Sup Doc as I67:13/4:11010 FM
10/70, $1.50; microfiche from NTIS as PB-1
447, $0.95. Water Pollution Control Research
ries 11010 FMY 10/70, September 1970. 174 p,
tab, 28 fig, 331 ref. FWQA Program 11010 FMY

Descriptors: *Oxidation lagoons, Groundwa
management, Soil treatment, *Irrigation wat
*Water reuse, *Waste water treatment, Michig
Water pollution sources, Biochemical oxygen
mand, Irrigation system, Domestic wastes, Indus
al water, *Pulp wastes.
Identifiers: Muskegon County (Mich), Spray irri
tion.

The feasibility of a lagoon treatment-spray irri
tion system for the combined domestic wastes a
industrial waste waters in Muskegon Coun
Michigan, was investigated in this study. The l
gest volume of industrial waste waters are th
discharged by a pulp and paper mill. Vario
aspects of the project were investigated includi
(1) sampling and analyses of waste waters fo
variety of parameters, (2) a review of available
formation concerning the effect of trace eleme
on soils and crops, (3) laboratory tests of
treatability of the combined waste waters by lago
treatment, (4) development of a simulation mo
to assist in analyzing the volume and water qual
aspects of a treated waste water storage lagoon,
soils and groundwater field and office studies
garding the management of groundwater levels
ensure an adequate aerobic treatment zone in
soil as well as to prevent ponding in the site ar
and (6) investigations of certain agricultu
aspects in using treated waste waters as spray
rigation water. The results of this work dem
strated the feasibility of the proposed project bas
on information developed during the study,
highlights of which are: (1) the waste waters do
contain constituents having concentrations th
would interfere with use of these waste waters
agricultural irrigation waters, (2) the treatability
the wastes by the proposed lagoon treatme
system was confirmed by the laboratory work, a
(3) the feasibility of management of the groun
water levels within the irrigation site area
drainage wells and tile was established by the
vestigations. (See also W69-09331)
W71-04186

**TREATMENT OF ACID MINE DRAINAGE F
FOAM SEPARATION,**
Horizons, Inc, Cleveland, Ohio.
J. J. Bikerman, P. J. Hanson, and S. H. Rose.

available from Sup Doc as I67:13/4:14010 12/70, $1.00; microfiche from NTIS as PB-70, $0.95. Water Pollution Control Research s, 14010 DEE 12/70, Federal Water Quality nistration, Washington, D.C., December 88 p, 11 tab, 10 fig, 19 ref, 4 append. FWQA am 14010 DEE.

riptors: *Foam separation, Mine wastes, Iron, um, Magnesium, *Surfactants, Water purifi-n, *Acid mine water, *Waste water treatment, e drainage, *Coal mine wastes, Costs, Ions.

experiments were conducted to establish the ility of foam fractionation in the treatment of coal mine drainage for the removal of the ions iron, calcium, manganese and magnesi-The independent variables controlling foam ation of metal ions were determined to be the ntration ratio of surfactant to iron, the air e throughput, the foam drainage time, the dissolved salt content and the type of surfac-sed. The major part of iron, calcium, man-e and magnesium can be foam separated from olution by proper control of the independent les. Reduction of residual surfactant concen-n in the treated water and reduction of water ned with the foam are two areas in need of r investigation. Foam separation was tested cid drainage, partially lime neutralized age and complete limestone neutralized age. Tests on model solutions indicate that nent of raw acid drainage is most feasible at nt. Operating and capital costs are estimated l and 1.0 MGD batch treatment plants.
04188

TRALIZATION OF HIGH FERRIC IRON MINE DRAINAGE,
rt A. Taft Water Research Center, Cincinnati,

r C. Wilmoth, and Ronald D. Hill.
available from Sup Doc as I67:13/4:14010 08/70, $0.50; microfiche from NTIS as PB-471, $0.95. Water Pollution Control Series 0 ETV 08/70, August 1970. 38 p, 18 tab, 8 fig, FWQA Program 14010 ETV.

riptors: Water Pollution Control, Acid ms, *Neutralization, Lime, Limestone, te water treatment iron compounds, ogen ion concentration, *Mine drainage, l mine water, *Ion, Aeration.
ifiers: Soda ash.

, limestone, and soda ash were studied as alizing agents for treatment of a ferric iron mine drainage water. Both continuous flow batch tests were used to determine the effec-ess of each of these neutralizing agents in ion with acid mine water. Comparisons made een the three neutralizing agents include: ical costs, reaction efficiencies, effluent water ties, sludge settling rates, sludge volumes, and nt solids of sludges. All three neutralizing s were capable of treating acid mine drainage. costs were half that of limestone for treating ame acid mine drainage because of the low ation of limestone. However, the charac-ics of the limestone sludge were superior to of lime and soda ash sludges. The cost for ash treatment was excessive. Further research proving limestone utilization is under way. No ences in reaction efficiency were found in dry ng or slurry feeding the neutralizing agents. tion during and/or after the limestone reaction ly increased the effluent pH but failed to in-e limestone useage efficiency or improve ef-t quality.
-04189

ERAL RECOVERY FROM CONCEN-TED BRINES,
am Young Univ., Provo, Utah.
rimary bibliographic entry see Field 02K.
-04223

ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
Kenneth James DeCook.
PhD Thesis, University of Arizona, 1970. 216 p, 10 fig, 27 tab, 75 ref. OWRR Project A-020-ARIZ (1).

Descriptors: *Water reuse, Salvage value, Recreation, Irrigation, *Costs, Model studies, Waste water treatment, Sewage treatment, Treatment facilities, Arizona, Water Quality Act.
Identifiers: *Tucson, Santa Cruz River, Pima County.

This thesis anlayzes the economic feasibility of using salvageable water from domestic-industrial effluents, as well as from storm runoffs for recreational, industrial and agricultural purposes in the Tucson area. The author determines the costs associated with the utilization of these waters and the benefits to be derived from each kind of use. He combines these net-benefit coefficients into a simple normative model which can be used for examining specific planning and operational adjustments in the regional salvageable water system. In the Tucson area the author concludes that the demand for water for recreational uses would support the construction of new sewage treatment facilities. (Holmes-Rutgers)
W71-04269

INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
Office of Saline Water, Washington, D.C.
Eric D. Bovet.
Journal American Water Works Association, Vol 62, No 9, September 1970, p 539-542. 10 tab.

Descriptors: *Demineralization, *Desalination, *Byproducts, Economics, Electro-osmosis, Reverse osmosis, Tertiary treatment, Waste treatment, Waste water treatment, Pollution abatement, Abatement.
Identifiers: *Desalting, *Byproduct recovery, Cheese wastes, Pulp and paper wastes, Iron and steel wastes, Plating and metal finishing wastes, Nuclear wastes, Coal mine wastes.

Desalting of industrial wastes is not a complete solution to the problem of their disposal, but it is of value of reducing the pollutional load on rivers and lakes. Desalting may be economically feasible when a salable byproduct is produced by the process. It has been estimated that a one-time market of $1.5 billion exists for desalting equipment between 1970 and 1990. Industries in which desalting may yield a profitable byproduct include, but are not limited to, the Cheese, Pulp and paper, Iron and steel, Plating and metal finishing, Nuclear power and Coal mining industries. Other large industries in which desalting may be profitable are the chemical and petroleum industries. The time is fast approaching when the profitability of desalting will be secondary to the need for reducing the pollution load on the environment. When this happens the market for desalting equipment will widen greatly. (Hewett-Rutgers)
W71-04286

5E. Ultimate Disposal of Wastes

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
Engineering-Science, Inc., Arcadia, Calif.
For primary bibliographic entry see Field 05C.
W71-04114

5F. Water Treatment and Quality Alteration

STREAM QUALITY MODELING BY QUASILINEARIZATION,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and Irving Hwang.
In: Modeling and Optimization of Water Resources Systems Phase I, Kansas State Univ, Appendix B4, (1970). 28 p, 2 fig, 8 tab, 6 ref.

Descriptors: *Mathematical modeling, *Stream improvement, *Water quality control, Least squares method, Constraints.
Identifiers: *Quasilinearization, Parameters, Differential equations.

A fairly effective technique for estimating parameters or coefficients in differential equations arising in stream quality modeling was introduced. The parameter estimation problem was treated as a two-point or multipoint boundary-valve problem by the quasilinearization technique. To illustrate the approach, a simple representation of stream quality which included BOD concentration, DO deficit and other physical constraints was considered. First, only three data points were used to estimate the rate constants. Then the case was shown where more than three data points were desirable to obtain and the classical least squares criterion was used so that the sum of the squares of the deviations was minimized. A generalized system of nonlinear differential equations was used to apply the quasilinearization technique and its computational procedure was shown. To test the effectiveness of the approach, given data were obtained numerically by solving two equations. Estimation of two parameters was shown as well as estimation of experimental errors, and estimation of three parameters. It was shown that with very approximate initial guesses for the unknown parameters, only three to five iterations were needed to obtain 4 to 5 digit accuracy. (See also W71-04043) (Kriss-Cornell)
W71-04045

5G. Water Quality Control

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 06A.
W71-03857

A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Clifford S. Russel, and Walter O. Spofford.
In: Natural Resource Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 66-86, 1970. 21 p, 4 fig, 1 tab.

Descriptors: *Optimization, *Mathematical models, *Linear programming, Diffusion, Damages, Quality control, Management.
Identifiers: *Non-linear programming, Residuals.

A conceptual framework for a large scale, regional environmental quality management model was discussed. The model was designed first to deal explicitly with the major forms of residuals--airborne, waterborne and solid wastes, and noise. It allowed physical tradeoffs among these in production and treatment. Secondly, it reflected possibilities of substitution within production processes. The model was divided into three parts: (I) a linear inter-industry model; (II) a set of environmental diffusion models; and (III) a set of receptor damage functions. The model aimed at an optimal selection of residual discharge levels from the production activities of a region. The computational procedure

involved non-linear programming techniques. The result of this computation was residual discharge vector. In order to test the quantitative procedure a didactic version of the model using a hypothetical region was used which consisted of a single river, two urban areas--an industrial area and a residential area, and miscellaneous activities. Two economic activities were analyzed: a beet sugar processing plant and a thermal power generating facility. This model could be used to explore solution sensitivity to the parameters of physical models and damage functions. (See also W71-03855) (Kriss-Cornell)
W71-03858

THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 05B.
W71-03872

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W71-03873

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resources Office.
For primary bibliographic entry see Field 05B.
W71-03874

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03875

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03876

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03877

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION: SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1112-1119, June 1970. 8 p, 103 ref.

Descriptors: *Systems analysis, *Waste water treatment, *Water pollution control, *Model studies, Economics, Political aspects, Stochastic processes, Application methods.

Literature on waste water and water pollution control for 1969, specifically pertaining to systems analysis, was reviewed. Articles reviewed included: systems analysis application to water supply and waste water disposal problems by Harrington; political influence on public policy in regional water quality models by Dorfman, Jacoby, and Loucks; economic models for regional water quality planning by several authors; systematic approach to minimum cost and salinity control in a river described by Coffey and Ortolano and others using alternate methods; river aeration problems by Davidson and Tarassov; thermal and organic wastes considered by Dysart and Hines; stochastic BOD and DO models for rivers developed by Custer and Drutchkoff; Boyd's examination of relation between pollution, income, and costs of augmenting waste assimilative capacity; flow augmentation benefits by Pyatt, et al; the 1961 Delaware Estuary study; Orlob's technique for representing the complex hydrodynamic behavior of estuarial environments; systems analysis of waste water treatment design and operation; models for activated sludge; systems analysis applied to waste water treatment design and unit process design by Galler; and effluent storage models studied by Sobel and Phillips, et al. Has 103 references. (Kriss-Cornell)
W71-03879

SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
Weston (Roy F.), Inc., West Chester, Pa.
Chia Shun Shih.
Journal Water Pollution Control Federation, Vol 42, No 10, p 1792-1804, Oct 1970. 13 p, 7 fig, 9 tab, 11 ref.

Descriptors: *Optimization, *Dynamic programming, *Model studies, *Water quality control, *Water management (Applied), Pollutants, Costs, Waste treatment, River basin.

A dynamic programming model was presented that minimized the total costs to water users and waste dischargers in a basin. The model could also identify direct benefits in terms of reduced treatment costs. The optimization criterion was to minimize total water supply and waste treatment costs and to maximize the direct benefits for the basin subject to regulatory agency constraints. The river basin model included both conservative and nonconservative pollutants in its optimization scheme yet nonconservative pollutant effects were emphasized. The optimization procedure was illustrated by a simplified example. The hypothetical cost functions used in the examples were compiled from past experience and various literature sources; the basic data were generalized for inclusion in the example. In formulating the model a hypothetical river system was developed. The most salient features associated with the application of the model presented were discussed. (Kriss-Cornell)
W71-03881

MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
Water Pollution Research Lab., Stevenage (England).
G. Knowles.
Chemistry and Industry, p 697-701, May 1970. 5 p, 5 fig, 6 ref.

Descriptors: *Mathematical models, *Water pollution control, *Computers, Activated sludge, Nitrification, Esturaries, Biochemical oxygen demand, Dissolved oxygen.

Some recent applications of mathematical models in water pollution control, including a brief discussion of types of computers suitable for such work, were described. First, the design of activated sludge plants to obtain nitrification was dealt with. Due to lack of adequate methods involving population dynamics, such models have not overcome many problems. Research has been conducted though exploring its basic mechanisms. One such mathematical model dealing with minimum period of retention of the waste water in an aeration tank for consistent nitrification was presented. Second, an example of a mathematical model used to aid in the management of estuaries which neglected tidal motion so that the water was regarded as always bein at half tidal level was given. Next, a mathematica model was developed for predicting biochemica oxygen demand values in an estuary and the exam ple used was an estuary on the South Coast of En gland. A model for predicting dissolved oxyge values in an estuary was presented last with an ap plication to the Thames Estuary. General purpos digital computers, analogue computers, and hybri computers were cited as those used for mathemat cal models. (Kriss-Cornell)
W71-03884

A LONG-TERM PLAN FOR SEWERAG DEVELOPMENT IN THE JOHANNESBURG RE GION,
Johannesburg City Engineer's Dept. (Sout Africa).
V. Bolitho.
Water Pollution Control, Vol 69, No 1, p 79-9 1970. 6 fig, 3 tab, 8 ref.

Descriptors: *Sewers, *Sewage disposa *Sewerage, Sewage, Pipelines, Pumping plants, Ur banization, Environmental sanitation, Water pollu tion control.
Identifiers: Johannesburg (South Africa).

The scope of the Johannesburg waste water schem and its future are dealt with in this paper. Adequat sanitation has been an essential prerequisite of ur banization and population predictions in this cit indicate a sanitation problem. The sustained rate o increase in sewage flows has been approximately 1/2% per year compounded and if this rate con tinues the quantities to be handled will double i 10-12 years meaning the same amount of sewerag and treatment facilities will have to be built in tha time as have been built in the past 60 years. Poss ble advancements in the technology of sewag treatment and progressive planning in sewerag systems and designs may alleviate some of the bur den caused by the increasing population. (Ellis Texas)
W71-03895

MINE WASTE WATER PROBLEMS IN EU ROPE,
Pennsylvania Dept. of Mines and Mineral Indus tries, Harrisburg.
For primary bibliographic entry see Field 05D.
W71-03898

A COMPREHENSIVE WATER QUALITY CON TROL PROGRAM FOR THE LAS VEGA WASH DRAINAGE BASIN. PHASE I.
Boyle Engineering, Las Vegas, Nev.; and Cornell Howland, Hayes, and Merryfield, Las Vegas, Nev.
For primary bibliographic entry see Field 05D.
W71-03901

A COMPREHENSIVE WATER QUALITY CON TROL PROGRAM FOR THE LAS VEGA WASH DRAINAGE BASIN.
Boyle Engineering, Las Vegas, Nev.; and Cornell Howland, Hayes, and Merryfield, Las Vegas, Nev.
For primary bibliographic entry see Field 05D.
W71-03902

APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN EN VIRONMENTAL MANAGEMENT,
Engineering Science, Inc., Oakland, Calif.; and General Behavioral Systems, Los Angeles, Calif.
W. E. Gates, R. M. Males, and J. F. Walker.
Water Resources Research, Vol 6, No 6, p 1549 1558, December 1970. 10 p, 5 fig, 3 ref, 1 append.

Descriptors: *Simulation model, *Dynamics *Decision making, *Water quality control, *Re gional analysis, Environmental engineering, California.
Identifiers: Feedback loop.

nic feedback modeling of decision making
ss of a California regional water quality board
arried out to study the interactions of the
with various groups having different vested
sts in water quality and the impact of these in-
ions on achieved water quality. Specific ap-
ions of the concepts of industrial dynamics to
onmental systems, termed environmental
n dynamics (ESD), was used to develop the
l of regional board decision making. Califor-
as divided into nine regions for the purpose of
quality management and each region ap-
d a regional board with associated staff and
tive officer (the extended board). The deci-
naking process was formulated as a continu-
nteraction and interplay between the com-
nts of the extended board and specific interest
s. The feedback loop structure used was di-
into five functional areas: generation, desired
y, perceived quality, negotiation, and
nse. The model was structured and tested for
tuation of two distinct interest groups: an in-
al waste discharger and a conservation group
aining opposing positions to an existing
arge. The model was useful for exploration of
plications of alternative institutional arrange-
. (Kriss-Cornell)
04025

**HEMATICAL PROGRAMMING APPLICA-
S TO WATER QUALITY PLANNING FOR
BOSTON HARBOR REGION,**
achusetts Inst. of Tech., Cambridge. Urban
ns Lab.
C. Schaake, Jr.
rt, TR-70-33 (1970). 75 p, 14 fig, 17 tab, 17

iptors: *Mathematical models, *Linear pro-
ning, *Water quality control, *Planning,
e treatment, Estuaries.
ifiers: *Boston Harbor, Differential equations,
rtainty.

se study of water quality planning for the
n Harbor, in which mathematical pro-
ning techniques were applied to seek the best
atives for investing in water pollution control
ies in order to meet target water quality
ia, was described. The control alternatives in-
d (a) waste treatment; (b) transmission of
d or untreated wastes to disposal sites
here in the harbor or surrounding area; and
torage of combined sewerage overflows. In
to supply information to the model about the
nse of the physical system to the inputs of
s at different locations, basic differential
ions governing the movement of water and
s in two-dimensional tidal estuaries were
d. These equations were linear but with time
ng coefficients. The technique for solving
equations permitted the harbor to be divided
irregularly shaped segments rather than a
rm grid of regularly spaced rectangular seg-
s. The model was operated for three assumed
itions to show the sensitivity of decisions to
rtainty in the available data. The first run was
e run; the second run tested the effect of un-
inty in costs of waste treatment; the third run
d the effect of rigid water quality constraint
. (Kriss-Cornell)
-04036

**/ATER-QUALITY SIMULATION MODEL
WELL-MIXED ESTUARIES AND
STAL SEAS: VOLUME I, PRINCIPLES OF
IPUTATION,**
Corp., Santa Monica, Calif.
rimary bibliographic entry see Field 06A.
-04038

**IVITIES OF THE FEDERAL WATER POL-
ION CONTROL ADMINISTRATION--
ER QUALITY STANDARDS.**
rimary bibliographic entry see Field 06E.
-04096

**WATER QUALITY CONTROL: A MODERN AP-
PROACH TO STATE REGULATION,**
For primary bibliographic entry see Field 06E.
W71-04101

**FEDERAL ENFORCEMENT UNDER THE
REFUSE ACT OF 1899,**
For primary bibliographic entry see Field 06E.
W71-04102

**FEASIBILITY STUDY OF MINING COAL IN AN
OXYGEN FREE ATMOSPHERE.**
Island Creek Coal Co., Holden, W. Va. Island
Creek Div; and NUS Corp., Pittsburgh, Pa. Cyrus
Wm. Rice Div.

Copy available from Superintendent of Documents
as I67:13/4:14010 DZM 08/70, $1.50; microfiche
from NTIS as PB-197 446, $0.95. Water Pollution
Control Research Series 14010 DZM 08/70, Au-
gust, 1970. 163 p, 13 tab, 21 fig, 20 ref. FWQA
Program 14010 DZM.

Descriptors: *Acid mine water, Mining, *Mining
engineering, Health, Safety, Communication
systems, Data acquisition, *Mine drainage, *Coal
mines, Methane, Oxygen.
Identifiers: Inert gas, Life support systems.

A systems evaluation was made to determine the
engineering feasibility and probable economics of
mining coal in an active deep mine in an oxygen
free atmosphere using current technology in the
application of life support systems to conventional
coal mining techniques. The project was Phase I of
a four phase program to demonstrate that mining
coal in an oxygen free atmosphere will prevent the
formation of acid mine water. Other major benefits
include improved working conditions from a health
and safety standpoint. A detailed investigation was
conducted into the application and suitability of
commercially available inert gas generators, life
support clothing and equipment, and personnel
communications systems. Three sites were in-
vestigated for a demonstration mine. The investiga-
tion revealed it is feasible from an engineering
standpoint to mine coal in an oxygen free at-
mosphere. Life support and associated equipment
are available essentially off-the-shelf. A deep mine
using conventional mining equipment can be
designed to operate in an oxygen free atmosphere.
The comparative economics are extremely favora-
ble when methane gas is recovered and sold.
W71-04187

**TREATMENT OF ACID MINE DRAINAGE BY
FOAM SEPARATION,**
Horizons, Inc, Cleveland, Ohio.
For primary bibliographic entry see Field 05D.
W71-04188

**NEUTRALIZATION OF HIGH FERRIC IRON
ACID MINE DRAINAGE,**
Robert A. Taft Water Research Center, Cincinnati,
Ohio.
For primary bibliographic entry see Field 05D.
W71-04189

**PROCEEDINGS: CONFERENCE ON POLLU-
TION OF LAKE MICHIGAN AND ITS TRIBU-
TARY BASIN, ILLINOIS, INDIANA,
MICHIGAN, AND WISCONSIN.**

Federal Water Pollution Control Admin, Vol 1,
(1969). 363 p.

Descriptors: *Lake Michigan, *Administration,
*Programs, *Pollution abatement, Michigan, Indi-
ana, Illinois, Water quality control, Legislation,
Wastes, Water pollution, Regulation, Municipal
wastes, Industrial wastes, Pesticides, Boats, Federal
government, State governments, Planning, Project
planning, Projects, Oil wastes, Water pollution
sources, Water analysis, Water pollution control.

In these proceedings of the Conference on Pollu-
tion of Lake Michigan and its Tributary Basin, re-
ports are given by the Army Corps of Engineers
and the states of Michigan, Indiana and Illinois.
The reports set forth steps taken to implement a
program previously established by the Conference.
That program includes recommendations covering
industrial wastes, dumping of polluted materials,
wastes from watercraft, pesticides, oil spills and
water quality analysis. Reports consist of progress
made by agencies charged with implementing the
program in the various states, the extent of com-
pliance with standards by the industries, mu-
nicipalities and individuals affected, and or-
dinances and legislation passed to effectuate the
Conference recommendations. (Douberley-
Florida)
W71-04256

**CITY OF SALEM V HARDING (CITY'S
NEGLIGENCE IN CAUSING ILLNESS BY CON-
TAMINATION OF WATER SUPPLY).**
For primary bibliographic entry see Field 06E.
W71-04278

**POLLUTION PROBLEMS, RESOURCE POLICY
AND THE SCIENTIST,**
New York State Coll. of Agriculture, Ithaca. Dept.
of Conservation.
For primary bibliographic entry see Field 06B.
W71-04280

**OFFSHORE OIL SPILLS: AN EVALUATION OF
RECENT UNITED STATES RESPONSES,**
For primary bibliographic entry see Field 06E.
W71-04305

**PEOPLE V PORT OF NEW YORK AUTHORITY
(REMEDY FOR POLLUTION OF STATE PRO-
PERTY).**
For primary bibliographic entry see Field 06E.
W71-04311

**REORGANIZATION PLAN NO. 3 OF 1970 (EN-
VIRONMENTAL PROTECTION AGENCY).**
For primary bibliographic entry see Field 06E.
W71-04325

**REORGANIZATION PLANS NOS. 3 AND 4 OF
1970.**
For primary bibliographic entry see Field 06E.
W71-04326

RULES OF PRACTICE AND PROCEDURE.
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 06E.
W71-04327

STATE WATER CONTROL LAW.
Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 06E.
W71-04335

**OUTLINE -- ENFORCEMENT OF 1899 REFUSE
ACT THROUGH CITIZEN ACTION.**
For primary bibliographic entry see Field 06E.
W71-04336

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
Maryland Univ., Baltimore. School of Law.
For primary bibliographic entry see Field 06E.
W71-04337

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
Purdue Univ., Lafayette, Ind. Water Resources Research Center.

Available from NTIS as PB-197 111, $3.00 in paper copy, $0.95 in microfiche. Proceedings of a Water Resources 1969 Seminar, Water Resources Research Center, Purdue University, Lafayette, Indiana, 1970. 245 p. Gerrit H. Toebes, (editor). OWRR Project A-999-IND (4).

Descriptors: *Natural Resources, Water resources, *Decision making, Cost allocation, *Economics, *Planning, Social aspects, *Systems analysis, Optimum development plans, Political systems, Political constraints, Non-structural alternatives, Air pollution, Costs, Operations research, California.
Identifiers: Oswego Basin (Calif), West Basin (Calif).

The text of the publication is based on a series of lectures given for the 1969 water resources seminar at Purdue University. The invited speakers were asked to present their material on a selected theme in an introductory manner with discussion following the formal presentation. The dialogues which ensued in the seminar are not given; however, the lectures are presented in the publication. The first paper is a concise introduction to systems analysis in natural resources management and its relation to the decision making process. The subsequent chapters are arranged according to a visualized hierarchy of systems. The emphasis on the papers II through VII is on the physical system and questions about its modeling, optimization and output evaluation. The papers VIII and IX take up questions in the economic system that is regarded as the environment of the physical system. The papers X through XIII emphasize components in the legal-political system representing the environment of the economic system. Taken together, the material makes for meaningful supplementary reading to the more formal course work in natural resource systems analysis that students are electing in increasing number. (See also W71-03856 thru W71-03868)
W71-03855

RESOURCE SYSTEMS MODELS IN DECISION MAKING,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
Gerrit H. Toebes.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana. Water Resources Research Center, Purdue, University, p 1-44, 1970. 24 fig, 4 tab.

Descriptors: *Decision making, *Model studies, *Systems analysis, *Analytic techniques, Ecology, Administration, Political aspects, Optimization, Management.
Identifiers: *Resource systems.

Resources systems models in decision making and their evolution are set forth in an introductory manner. A liberal use of graphics is made to illustrate the various generic terms in common use; and the operational role of systems analysis in ecological, administrative, and political concerns with water resources use, is noted and portrayed diagrammetrically. Basic systems concepts and systems morphology are defined. Systems synthesis and systems optimization are seen as rather separate activities. A hierarchy of systems is defined and taken as a starting point for model synthesis and decomposition of systems models into functions. A brief introduction to systems analysis techniques is followed by a short discussion of systems evaluation. Finally, the significance of the systems approach to actual decision making in natural resource development and management is considered. (See also W71-03855) (Davis-Chicago)
W71-03856

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
Michigan Univ., Ann Arbor. School of Public Health.
Rolf A. Deininger.
In: Natural Resources Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 45-65, 1970. 21 p, 11 fig, 9 ref.

Descriptors: *Systems analysis, *Planning, *Water supply, *Pollution abatement, Sewage treatment, Waste water treatment.

The purpose of this paper was to review the role of systems analysis in the planning of water supply systems and pollution control works. Six examples were briefly outlined which showed the use of new techniques on practically every level of pollution control and water supply engineering. First, the standard steps in a systems analysis study were shown as well as the techniques and tools available for use. These included linear and dynamic programming, digital computer, simulation techniques, etc. The specific examples used to illustrate the use of these techniques were entitled; (a) design of a sewer system; (b) design of sewage treatment plants; (c) design of intercommunity waste water collection and treatment systems; (d) river basin-wide planning; (e) conversational design of treatment plants and automatic plotting of plans and (f) a water supply problem pertaining to the city of Ankara, Turkey. (See also W71-03855) (Kriss-Cornell)
W71-03857

A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-03858

THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
Temple Univ., Philadelphia, Pa. Dept. of Economics.
Azriel Teller, and J. R. Norsworthy.
In: Natural Resource Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 87-99, 1970. 13 p, 4 fig, 3 tab, 13 ref.

Descriptors: *Mathematical models, *Linear programming, *Simulation analysis, *Optimization, Air pollution, Quality control, Costs.

Some current work in developing models to evaluate alternative strategies for air resource management was outlined. The social objective was the minimization of the total cost of air pollution to society subject to varying institutional constraints. Two basic models were developed. One, the linear programming model used in conjunction with meteorological transport coefficients, permitted the design of an economically efficient system of air pollution control. In order to achieve higher air quality for a given dollar outlay, or to lower the cost of achieving a given air quality standard, selective, instead of uniform abatement and intermittent abatement based on forecasting meteorological conditions, rather than continuous abatement, were used. The more general simulation program described not only optimized the model but permitted consideration of non-linear functions as well as limited management of the time-phased abatement investment decision problem facing industries. By adjusting parameters in the simulation program, the sensitivity of the optimal abatement plan design to uncertainty in cost, meteorologica and other data was determined. A method for es mating the cost of satisfying a sequence of quali standards over several years was discussed. (Se also W71-03855) (Kriss-Cornell)
W71-03859

PLANNING FOR THE OSWEGO BASIN I NEW YORK--A SYSTEMS APPROACH,
New York State Div. of Water Resources, Albany.
Allen C. Tedrow.
In: Natural Resource Systems Models in Decisio Making, Water Resources Research Center, Pu due Univ, p 100-114, 1970. 15 p, 11 fig.

Descriptors: *Simulation analysis, *Systems analysis, *Optimization, *Reservoir operation, *Mathematical models, Cost-benefit analysis, Lake Canals, Flood control, New York.
Identifiers: Oswego Basin.

A simulation model, used to seek an optima operating policy and to do planning for new work for the Oswego Basin in New York, was develope according to the basic objectives of the New Yor State Division of Water Resources. These basic ob jectives were that (a) the plan should be multipu pose; (b) the plan should be comprehensive; an (c) affected parties may participate in decisio making. The Oswego Basin has a drainage area o some 5,100 sq. miles and contains 9 major lake six of which are under local control, the other thre comprising a reservoir-canal system under stat management. Finding better management an regulation plans for the existing reservoir syste was the problem to be solved. To define the system two simulation models--one for flooding and on for budgeting monthly flows, were developed. Th model consisted of some 50 nodes and some 3 unit hydrograph inputs. It was subdivided into th following sectors: (a) flood damage, (b) conserva tion, (c) quality, (d) supplementary irrigation, (e water supply, (f) navigation, (g) recreation (in cluding boating), and (h) fish and game. The floo simulation sector had a time scale considerably les than the monthly scale of the other sectors. In th studies outlined, the primary measurement criteri was net costs and benefits as best they could b identified. (See also W71-03855) (Kriss-Cornell)
W71-03860

WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 06B.
W71-03861

INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06B.
W71-03862

PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06C.
W71-03863

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-03864

THE LEGAL SYSTEM: STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
Indiana Univ., Bloomington. School of Law.
For primary bibliographic entry see Field 06E.

865

TIONS OF LEGAL AND POLITICAL ILITY,
Univ., Bloomington. Dept. of Political
ary bibliographic entry see Field 06E.
866

UTIONAL DESIGN FOR WATER TY MANAGEMENT: THE IMPLICA- OF A SYSTEMS APPROACH FOR AND ADMINISTRATIVE ARRANGE-
in Univ., Madison. Dept. of Regional
ary bibliographic entry see Field 06E.
867

ACTION AMONG NATURAL RCE SYSTEMS, THE DECISION S AND THE PUBLIC IN THE 2000's,
te Univ., Ames. Dept. of Civil Engineering.
ary bibliographic entry see Field 06B.
868

IEW OF THE 1969 LITERATURE ON WATER AND WATER POLLUTION OL, ADMINISTRATION: SYSTEMS SIS,
Univ., Ithaca, N.Y.
ary bibliographic entry see Field 05G.
879

M OPTIMIZATION FOR RIVER BASIN QUALITY MANAGEMENT,
(Roy F.), Inc., West Chester, Pa.
ary bibliographic entry see Field 05G.
881

EMATICAL MODELS AS AN AID IN OLUTION OF WATER POLLUTION OL PROBLEMS,
Pollution Research Lab., Stevenage (En-
ary bibliographic entry see Field 05G.
884

R RESOURCES SYSTEMS ENGINEER-
ia Univ., Riverside. Dept. of Engineering; ifornia Univ., Los Angeles. Dept. of En-g.
Hall, and John A. Dracup.
v Hill Book Co, Series in Water Resources vironmental Engineering, New York, 1970. 2 fig, 2 tab, 325 ref.

tors: *Systems analysis, *Optimization, resources, *Engineering, Decision making, ons research, Groundwater, Water quality California.

fundamentals of the systems approach to x water resources problems were discussed ecific systems and subsystems as examples of their value as analytical methods ed and adapted to particular water s. The introductory chapter explained the r the best possible analysis to back the deci-cess. The case for systems analysis, if prac-y competent, professional water engineers, ablished. A review of the characteristics of esources systems as they relate to opera-search methodologies was then given. The ental procedures for several methodologies y the systems-engineer were presented. ossible objective functions for the analysis r resources systems were identified and the city of noncommensurate objectives of x systems was emphasized. Analyzed were a m of water resources subsystems selected so e methods and results were compatible in objectives, inputs and outputs. The primary water use subsystems noted were agricultural. The investment-timing problem was emphasized. The northern California supply subsystem was taken as the prototype for an analysis of water resources subsystems in the planning of a complex water supply-distribution-use system. Groundwater resources and water quality subsystems were discussed. Has 325 references. (Kriss-Carol)
W71-03885

DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen m.b.H., Mannheim (West Germany); and Wisconsin Univ., Madison. Dept. of Civil Engineering.
Paul M. Berthouex, and Lawrence B. Polkowski.
Journal of the Sanitary Engineering Division, ASCE, Vol 96, No SA5, p 1183-1210, October 1970. 28 p, 12 fig, 5 tab, 2 append, 63 ref.

Descriptors: *Optimization, *Mathematical models, *Systems analysis, *Economies of scale, *Forecasting, Costs, Sewage treatment, Probability, Sanitary engineering.

Economic safety factors have been developed to provide a hedge against errors inherent in using population forecasts. Optimal treatment plant expansions were calculated by minimizing the expected value of long-term investment costs. Factors considered were growth rate, forecast uncertainty interest rate, inflation, and learning-curve effect, and construction cost economy-of-scale. When a linear growth rate was anticipated, the interest rate and the economy of scale factor M determined the design period, the growth rate did not. However, when the growth rate was uncertain, it was possible to hedge against the possible cost of selecting the wrong period of design by reducing the design capacity 5 to 10%. Exponential growth always yielded a shorter design life than the linear growth pattern. Therefore, even when a linear growth in demand was not expected, it was helpful to use the linear growth expansion criterion to establish an upper bound on the design capacity. The examples presented suggested simple optimization methods which were applicable for some situations, and introduced the concept of applying safety factors as a hedge against uncertainty in design forecasts. (Kriss-Cornell)
W71-04026

TOOLS FOR WATER-RESOURCE STUDY,
Illinois State Water Survey, Urbana.
Julius H. Dawes.
Journal of the Irrigation and Drainage Division, ASCE, Vol 96, No IR4, p 403-424, December 1970. 22 p, 18 fig, 3 tab, 10 ref, 2 append.

Descriptors: *Water resources development, *Cost-benefit analysis, Reservoirs, Pumps, Wells, Sewage treatment, Data collection, Management, Economics.

Studies that have been made or are currently under way at the Illinois State Water Survey on the cost and benefit of various elements of water resource development were described. Some of the Illinois studies completed were: Cost of Reservoirs; Costs of Wells and Pumps, Water Transmission Costs; Cost of Pumping Water; and Cost of Sewage Treatment. A full account, including data collection, data analysis, and cost comparisons, were given for each study. Examples for use of the methods developed were also presented. The Illinois State Water Survey intended that these tools be used as a basis for comparison between alternatives for creation of water resource use, development and, management models. The results were said to have the same degree of certainty as incorporated in the basic data. The costs estimates will be helpful in linking quantity, quality, and economic parameters to the physical system, and alternative solutions to meet the objectives determined by economic, social and political criteria will be possible. Planners and decision makers will be in a more favorable position knowing what the alternatives and consequences will be from their actions. (Kriss-Cornell)
W71-04027

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
California Univ., Riverside. Dry-Lands Research Inst.; and New South Wales Univ., Kensington. School of Civil Engineering.
For primary bibliographic entry see Field 03B.
W71-04028

APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 04A.
W71-04030

OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
New Mexico State Univ., University Park. Engineering Experiment Station.
Jon D. Hicks, and J. V. Lunsford.
Technical Report No 65, August 1970. 176 p, 31 fig, 8 tab, 4 append, 9 ref. NMSU-EES-65-70.

Descriptors: *Optimization, *Correlation analysis, *Computer programs, *Project planning, *Relocation, *Precipitation (Atmospheric), Data collection, Mapping, New Mexico.
Identifiers: Jemez Mountains.

One of the stated objectives of the Weather Modification Research Program being conducted in the Jemez Mountains by New Mexico State University was the development of an adequate terrestrial precipitation measurement system. The objectives of this study were to determine, by correlation analysis, if the precipitation station locations utilized in the first winter of operation were located for the most effective data collection and to develop procedures for analysis by which subsequent data from relocated stations could be similarly analyzed. Computer programs were presented which computed the necessary statistics needed in the evaluations and a graphical mapping procedure was presented which aided in the understanding of the statistics computed. Based on the correlation of the event totals of each station with all other stations, and the areas of iso-correlation as shown on the maps, eleven stations could be relocated for more efficient data collection. It was recommended that a minimum distance of five miles between the stations in all directions be suggested for efficient data collection. A map of a possible relocation pattern based on the results of this study was shown. (Kriss-Cornell)
W71-04033

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
Massachusetts Inst. of Tech., Cambridge. Urban Systems Lab.
For primary bibliographic entry see Field 05G.
W71-04036

AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
Water Resources Engineers, Inc, Walnut Creek, Calif.
For primary bibliographic entry see Field 04A.
W71-04037

A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS: VOLUME I, PRINCIPLES OF COMPUTATION,
Rand Corp., Santa Monica, Calif.

J. J. Leendertse.
Memorandum, RM-6230-RC, February 1970. 71 p, 27 fig, 15 ref.

Descriptors: *Simulation analysis, *Mathematical models, *Water quality control, Estuaries, Coasts, Tidal waters, Flow, Wastes, New York.
Identifiers: Jamaica Bay.

The principles of computation of water quality simulation in well-mixed estuaries and coastal seas were described. The model was based upon numerical integration of the flow equations which simulated the water movements of tides and upon numerical integration of the advective diffusion equation which represented the movement of dissolved waste constituents. The partial differential equations which formulated the two-dimensional movement of waste constituents were approximate by two difference equations, which were used in succession for a step-by-step solution in time. To assess the validity of the results obtained an analysis was made of the behavior of the solution method. The computational procedures were tested on models of Jamaica Bay, Long Island, New York. A model with a computational grid size of 500 feet was used for the computational tide levels and velocities in this shallow bay, which has many tidal flats. In addition, the dispersion of coliform bacteria from a large number of time-varying sources were computed. (Kriss-Cornell)
W71-04038

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: PROGRESS REPORT NO 1,
California Univ., Los Angeles.
C. M. Duke, and J. A. Dracup.
Progress Report No 1, June 1970. 57 p, 11 fig, 78 ref, append. OWRR Project B-017-CAL (1).

Descriptors: *Optimization, *Water resources development, *Earthquakes, *Costs, Statistical methods, Damages, Risks.

Water resource system planning was optimized with respect to earthquake risk by incorporating the earthquake and cost functions into the optimization process. Emphasis was placed on water resource systems rather than individual structures or components. The focus was on planning decisions such as aqueduct routing and reservoir locations. The earthquake effects considered were classed as (1) violent shaking and (2) permanent differential displacements related to fault movement. Some guidance as to costs of making system components earthquake resistive was provided through documented cases of damage and non-damage in past earthquakes. The key cost parameter in this research was the cost to design, build and maintain the structure to withstand effects that have produced failures. The generation, flow and processing of information relative to the earthquake effects on a designated type of structure at a specified site in a water resource system was shown. Cost provided the language as well as the criteria for optimization and the cost increment to enable the system to resist earthquake effects was represented. Distribution of earthquakes was expressed statistically in terms of size, space and time. Specific forces, due to shaking and fault slip, applied to the structure by earthquakes that occur over its design life were determined. The procedure used led to an estimate of the incremental earthquake cost of placing a particular type of structure (e.g. an earth dam) on a specific site (e.g. Bouquet Canyon). (Kriss-Cornell)
W71-04041

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
Arizona Univ., Tucson. Hydrology and Water Resources.
For primary bibliographic entry see Field 04B.
W71-04042

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
F. S. Lee, L. E. Erickson, L. T. Fan, P. D. Dand, and R. S. Shastry.
OWRR Grant No 14-01-0001-1962. Completion Report (1970), various pagings. 50 fig, 31 tab, 105 ref, 13 append.

Descriptors: *Optimization, *Model studies, *Dynamic programming, *Stochastic processes, *Water resources development, Reservoirs, Linear programming.
Identifiers: *Techniques, *Steady state conditions.

Recently developed techniques used in water resources modeling and optimization were presented. Three general classes of problems dealt with were: the modeling and optimization under steady state conditions, the modeling and optimization under dynamic or unsteady state conditions, and stochastic modeling optimization. Results obtained were summarized under the titles: single reservoir system, multiple reservoir system, the establishment and up-dating of water resources model, and development of additional techniques. The detailed discussion of these problems was presented in each of the appendices. Such specific techniques as dynamic programming, a search technique, the stochastic maximum principle, conjugate gradient and gradient projection, quasilinearization, and others were used to formulate the models described in the individual papers. (See also W71-04044 thru W71-04047) (Kriss-Cornell)
W71-04043

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 04A.
W71-04044

STREAM QUALITY MODELING BY QUASILINEARIZATION,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 05F.
W71-04045

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 04A.
W71-04046

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and P. D. Dand.
In: Modeling and Optimization of Water Resources Systems Phase I, Kansas State Univ, Appendix B2, (1970). 22 p, 2 fig, 5 tab, 10 ref.

Descriptors: *Optimization, *Water resources, Multiple-purpose reservoirs, Computers, Constraints.
Identifiers: *Gradient projection method, Nonlinear programming.

The gradient projection model was applied to the optimization of complex water resources systems. This was a nonlinear programming technique used to treat the nonlinear utility functions without simplification and to solve the large number of variables involved without dimensionality difficulties. Two water resources problems involving multiple reservoirs and multiple purposes were solved by the technique. To illustrate the approach, an example solved by Maass and coworkers was solved b gradient projection method. The two multi-pur reservoirs used had the purposes of irrigation power generation. It was assumed that there two seasons in a year, the dry season and the season. The flow data and flow balances shown. Constraint equations were formulated the problem was solved by the gradient projec method. A four-period water resources model then shown. With very approximate ini guessed values on the variables, only three to iterations with a few seconds computation needed to obtain the optimum. (See also W 04043) (Kriss-Cornell)
W71-04047

NATURE'S LAW AND MAN'S ETHIC,
Army Engineer District, Omaha, Nebr. De Branch.
For primary bibliographic entry see Field 04C.
W71-04069

THE MANAGEMENT OF FORES WATERSHEDS FOR DOMESTIC WATER S PLIES,
Forest Service (USDA), Upper Darby, Northeastern Forest Experiment Station.
Edward S. Corbett.
Proc Conf Multiple-Use of Southern Forests Forest Res Council and Ga Forestry Assoc, p 38, 1970.

Descriptors: *Domestic water, *Water management, *Water yield improvement, W quality, Recreation, Forestry, Northeast U.S.

The Northeastern Forested Municipal Water Survey elicited 626 completed questionnaires f municipalities, private water companies, and S and Federal agencies. Over 2 million acres of in the Northeast are under control of over management units as water-source areas or pro tion lands for municipal water supplies. Increa water yield, protecting water quality, mee recreation demand, and other problems discussed. (Reinhart-Forest Service)
W71-04244

6B. Evaluation Process

NATURAL RESOURCE SYSTEMS MODELS DECISION MAKING.
Purdue Univ., Lafayette, Ind. Water Resou Research Center.
For primary bibliographic entry see Field 06A.
W71-03855

WATER RESOURCES PLANNING IN T URBAN-METROPOLITAN CONTEXT,
North Carolina Univ., Chapel Hill. Dept. of and Regional Planning.
Maynard M. Hufschmidt.
In: Natural Resource Systems Models in Decis Making, Lafayette, Indiana, Water Resou Research Center, Purdue University, p 115-1 1970. 5 fig, 8 ref.

Descriptors: *Planning, *Cities, *Methodolo *Water resources, River basins, Economic effici cy, Federal government.
Identifiers: *Metropolitan water resource mana ment, Urban water systems planning, Wa resource planning, Income redistribution, Envir mental quality, Objectives, River basin planning.

The major emphasis in water resources planning federal agencies is on macro-systems in a ri basin context. This planning practice is increasin less relevant to metropolitan water resou development. This gives rise to two types questions. First, what is being done in the way urban water systems planning and which are systems characteristics. Second, what changes the water planning methodology are needed in

an context. The often advanced objectives of nomic efficiency, income redistribution, and ironmental quality remain basic, but the rela- attention to specific problems will change. A ic problem is the divergence between urban and eral objectives where federal funding of needed ks is involved. Such divergence becomes more arent when considering refinement of basic ob- ives in the form of guides and criteria. The eral attention to the river basin can be at odds conditions following from urban geography. the ranking of problems as to significance eals basic differences. These topics are ussed with the aid of examples drawn from an settings in the eastern USA. (See also W71-55) (Davis-Chicago)
1-03861

ORPORATING SOCIAL OBJECTIVES IN TEMS MODELS,
tucky Univ., Lexington. Dept. of Civil En- ering.
Douglas James.
Natural Resource Systems Models in Decision king, Lafayette, Indiana Water Resources earch Center, Purdue University, p 136-151, 0. 3 tab, 10 ref.

criptors: *Planning, *Analytic techniques, aluation, Model studies, Economic efficiency, ems analysis, Flood protection.
tifiers: *Social objectives, Environmental ity, Regional development, Income redistribu- , Financial stability.

er resources planners are now beginning to gnize the need to supplement the evaluation of posed projects from the viewpoint of economic iency with consideration of such social objec- s as environmental quality, regional develop- t, income redistribution, and financial stability. ects can be used to accomplish or serve to de- these objectives in many different ways. Pro- formulation for a specific flood hazard area, example, seeks the most appropriate combina- of structural, flood-proofing, and land-use- riction measures. The evaluation requires rmination of the effects of each combination of sures on each social objective. An alternate ap- ch is to estimate implied weighting factors n past resource development decisions and ceed through a comparison of alternatives seek- to maximize the resulting scalar index of value. approach can be used in systems modeling to d periodic stops for inputting outside value gements. Sensitivity studies can be used to eval- the implications of giving a variety of ghtings to relevant objectives. The model der can only legitimately determine how ex- sed needs are best supplied; the people must ress the objectives. (See also W71-03855) vis-Chicago)
1-03862

VATE AND SOCIAL COSTING AS DECI- N DETERMINANTS IN WATER SOURCES,
gers-The State Univ., New Brunswick, N.J. ter Resources Research Inst.
. Whipple, Jr.
Natural Resource Systems Models in Decision king, Water Resources Research Center, Pur- University, Lafayette, Ind., p 162-178, 1970.

criptors: *Economics, *Interest, *Risk, *Costs, cision making, Benefits, Cost-benefit-analysis, nomic justification, Resource allocation, Third y effects, Social aspects.
tifiers: *Social costs, *Externalities, Opportu- costs.

paper's theses are (a) just as private costs are d in business decisions, social costs should be rminants in public decision-making; (b) many ciples of social cost determination are available use; (c) such principles are absent when it es to interest rate and taxation questions; (d) work on the social cost of pollution is urgently needed. Differences in rates of return after taxes can be ordered in terms of disutility of unexpected losses. It is proposed that the social cost of Federal investment be computed using a discount rate equal to that of Federal bonds, less an allowance for currency depreciation, plus an allowance for risks assumed. It is reasoned that the relationship between taxation and social costs is in need of much more investigation before the established system can be declared unsound. (See also W71-03855) (Whipple-Rugers)
W71-03864

INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000's,
Iowa State Univ., Ames. Dept. of Civil Engineering.
Merwin D. Dougal.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue, University, p 222-245, 1970. 8 fig, 2 tab, 23 ref, 3 append.

Descriptors: *Decision making, *Natural resources, *Institutional constraints, Technology, Attitudes, Social aspects, Political aspects, Environment.
Identifiers: *Environmental management, *Resource management.

The areas of relevance in regard to the interaction considered herein are: (1) attitudes, (2) knowledge, (3) technology, (4) choices and decision making, and (5) public institutions for environmental management. Attitudes need to be redirected from that of entrepeneurial service to public service. The major area of inadequacy with respect to knowledge lies in the response of natural environment to man's activities. Technology is limited in its problem-solving capability by the inadequacy of knowledge of environmental response. Making choices and decisions involves many intangibles. Therefore, attitudes become increasingly important to the decision-making process. Regional insitutions for resource and environmental management must be developed if real progress in problem-solving is to be accomplished. These concepts are illustrated by results of several local studies set in Iowa. (See also W71-03855) (Davis-Chicago)
W71-03868

AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
Metcalf and Eddy, Inc., Palo Alto, Calif.

Report to the Contra Costa County Water Agency, Martinez, California, November 16, 1965. 287 p, 37 fig, 56 tab, 61 ref.

Descriptors: *Economic prediction, *Evaluation, *Water quality control, *Deltas, *Water pollution control, *Encroachment, *Saline water-freshwater interfaces, Salinity, Sea water, Saline water intrusion, Estuaries, Brackish water, Tidal effects, Annual benefits, California.
Identifiers: *Contra Costa County, San Francisco Bay, Sacramento-San Joaquin Delta.

An attempt was made to reduce to the cost frame of reference the benefits or detriments to those segments of the County's economy which may be affected by changes in the quality of the offshore waters, now and in the future. The uncertainty of future Delta water supplies has required that the recent past historical water quality be used as a basis for benefit determinations. The benefits included are those which are susceptible of monetary evaluation. This area studied is the central and eastern portion of the County and represents about 30 percent of the total county. The two main sources of impaired water quality are: (1) salt water incursion from San Francisco Bay; (2) mineralization of the fresh offshore waters by return flows of irrigation from the Central Valley via the San Joaquin River system. Offshore water quality criteria are assumed for two distinct methods of achieving quality control: (1) construction of a physical barrier at Dillon Point or Chipps Island, and (2) a hydraulic barrier consisting of regulated fresh water outflows for salinity repulsion. Estimates are given of the annual savings to presently established and future industry and the economic benefits related to groundwater, recreation, fisheries, agriculture, municipal water supplies, unimproved land values, and the assimilative capacities of offshore waters. Benefits are estimated for the present and the year 2000. (Poertner)
W71-03909

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
Metcalf and Eddy, Inc., Palo Alto, Calif.

Report to the Contra Costa County Water Agency, Martinez, California, April 8, 1969. 103 p, 14 fig, 4 tab, 8 ref.

Descriptors: *Economic prediction, *Evaluation, *Water quality control, *Water pollution control, *Encroachment, *Saline water-freshwater interfaces, Deltas, Salinity, Sea water, Saline water intrusion, Estuaries, Tidal effects, California.
Identifiers: *Contra Costa County, *Sacramento-San Joaquin Delta.

Specific water quality control proposals were evaluated and the effects studied of a diminishing fresh water supply on Western Sacramento-San Joaquin Delta water quality and on the economy and environment of the area. Where possible, monetary values have been assigned. Chloride-ion concentration was selected as the primary control constituent because it is an indicator of the degree of salt water incursion in the estuarine system of the Western Delta. Other water quality constituents, such as total dissolved solids and total hardness, were also considered because of their effects on the market uses of water. Three factors influence the future availability of Contra Costa's offshore water supply: (1) increasing upstream depletions and out-of-basin export; (2) increasing quantities of agricultural, municipal and industrial wastes which are discharged to tributary receiving waters upstream from the Western Delta; (3) changes in the tidal hydraulics of San Francisco Bay and the Delta from land filling and reclamation projects. Conclusions concerning ecological changes and the economic impact of alternative water conditions are presented, based on the year 2000 and the present. The monetary benefits or detriments to Contra Costa's water-using industry, municipalities and agriculture have been computed for three distinct offshore water quality conditions. The economic effects of water quality changes on wastes dischargers have also been determined.
W71-03910

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-03917

TOOLS FOR WATER-RESOURCE STUDY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06A.
W71-04027

COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
Harvard Univ., Cambridge, Mass.
L. M. Eisel.

Water Resources Research, Vol 6, No 4, p 1239-1241, Aug 1970. 4 p, 1 fig, 7 ref.

Descriptors: *Evaluation, *Linear programming, *Reservoir design, Management, Constraints.

The author discussed ReVelle's et al proposed reservoir operating policy which simplified reduction of probabilistic chance constraints to their deterministic equivalents. A comparison to Young's, Bryant's, and Watermeyer and Thomas' investigations of optimal and near optimal linear operating rules was made. In both the deterministic and stochastic models, the assumptions were unclear regarding initial storage, which was expressed as a function of reservoir capacity. The form of the constraints incorporated into the stochastic case was also unclear. ReVelle, et al gave insufficient demonstration that their chance-constrained model adequately represented reality for preliminary screening or more advanced design purposes. (Kriss-Cornell)
W71-04029

PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 04A.
W71-04034

REPLY,
Geological Survey, Washington, D.C.
W. Kirby, C. ReVelle, and E. Joeres.
Water Resources Research, Vol 6, No 4, p 1242-1245, Aug 1970. 4 p, 4 ref.

Descriptors: *Optimization, Evaluation, Reservoir Operation, Design, Management, Economics.
Identifiers: *Linear decision rule (LDR).

A reply to comments made by Loucks and Eisel on the authors' paper 'The Linear Decision Rule in Reservoir Management and Design' was made (See also W70-10054). These comments illuminated several problems in the interpretation and economic justification of linear decision rules. Four specific points were made: (1) that the observation that Young's linear operating rules were of a different form from the linear decision rule (LDR) was embarrassingly correct; (2) that Loucks' interpretation of the initial storage constraints was correct and applied equally well to the deterministic formulation; (3) that Loucks suggests that the LDR does not deal effectively with serially dependent input processes; and (4) that Eisel points out that the LDR model should be compared with more realistic models to validate the LDR assumptions and to assess the quality of the LDR design. Despite these and other objections, the authors try to prove that the LDR bears consideration as a useful complement to existing optimization models and as a conceptual basis for further development of reservoir management theory. (Kriss-Cornell)
W71-04035

SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 02E.
W71-04040

WATERSHED PROJECTS.
For primary bibliographic entry see Field 06E.
W71-04104

IRRIGATION DEVELOPMENT IN TUNISIA,
California State Coll., Long Beach. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-04232

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
Iowa Univ., Iowa City. Inst. of Urban and Rural Research; Iowa Univ., Iowa City. Dept. of Geography; and Northern Illinois Univ., De Kalb. Dept. of Geography.
Frank E. Horton, Harold McConnell, and Ranjit Tirtha.
Tijdshrift voor Economische und Sociale Geografie, Vol 61, No 2, p 101-113, March-April 1970. 7 fig, 10 tab, 9 ref.

Descriptors: *Regional analysis, *Estimating equations, *Statistical methods, *Water utilization, *Geographical regions, Correlation analysis, Regression analysis, Frequency analysis, Arid lands, Humid climates, Data collections, Mapping, Social aspects, Economic efficiency, Foreign countries, Tropical regions, Topography, Climates, Regions, Environmental effects, Water users, Natural resources, Water resources, Analytical techniques, Moisture availability, Urbanization, Rural areas, Agriculture, Spatial distribution, Variability.
Identifiers: *Socio-economic patterns, *India, *Developing countries, Multivariate principle components analysis.

An attempt is made, using Indian government data, to identify underlying patterns of areal association using 15 selected socio-economic indices (variables) which are considered to reflect the significance of India's socio-economic structure, statistical techniques were designed to elicit a maximum amount of information from a minimum number of relevant variables. Product-moment correlation coefficients were used as inputs to a multivariate principle components analysis and the basic association patterns of India's socio-economic structure emerged: socio-economic development, socio-economic underdevelopment, incipient commercialization, rural manufacturing and agricultural intensity. The physical, social and economic factors underlying these patterns are described, the spatial variations mapped and the data analyzed for internal homo-or heterogeneity. The highest positive values showed systematic clustering, conforming to major political and physical subdivisions. The major categories of socio-economic structure are associated mainly with social and water availability factors. The categories are: (A) developed urban-involving literate populations and large-scale industry; (B) backward tribal areas with inhospitable terrains such as forest cover or arid lands, augmenting inaccessibility; (C) flat, fertile lands and an adequate water supply with or without irrigation, supporting an urban-rural hierarchy; (D) areas of comparatively low water availability where agricultural income is supplemented with household activities and (E) areas with the greatest water availability, whether irrigation or rainfall, and with sufficient market incentives. (Casey-Arizona)
W71-04234

ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
Maryland Dept. of Chesapeake Bay Affairs, Annapolis; and Maryland Univ., College Park. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06D.
W71-04267

ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.

Fourth New York Fishery Biologists' Seminar, Department of Conservation Extension Series, No 1, March 28, 1968. 23 p.

Descriptors: *Planning, *Cost-benefit analysis, Natural resources, New York, *Sport fishing, Fish management.
Identifiers: *New York State's PPB system, Adirondacks, Ciriacy-Wantrup.

These five short papers, four of which were w
by Cornell University Natural Resource Prof
and one by the Director of Program Planni
the New York State Conservation Departme
describe the need for a diversified approa
solving natural resource problems. Divers
methods of planning and programming, eco
analysis, benefit-cost methodology, as well as
sification of natural environments are advo
Since planning the conservation of n
resources requires consideration of benefit
costs which do not lend themselves to dollar v
the authors have suggested various metho
taking these non economic factors into ac
These five papers were presented at the F
New York Fishery Biologists' Seminar on M
28, 1968. Appropriate portions of the public
are forwarded with abstracts of these portions
also W71-04272 thru W71-04274) (Holme
gers)
W71-04271

THE ROLE OF ECONOMIC EVALUATIO GOVERNMENTAL ANALYSIS,
New York State Coll. of Agriculture, Ithaca.
of Conservation.
Robert J. Kalter.
In: Aspects of Planning, Evaluation and Dec
Making in Sport Fishery Management, Depart
of Conservation Extension Series No 1, C
University, May 28, 1968, p 12-13.

Descriptors: *Cost-benefit analysis, Input-o
analysis, *Evaluation, Economics, Govern
finance.
Identifiers: Corps of Engineers.

The author describes the advantages and
vantages of the analytical tool cost-benefit an
for evaluating government programs. He exp
that this type of analysis is not adaptabl
evaluating projects which have several varie
jectives and goals. He suggests that tools like i
output analysis to quantify regional develop
effects and the various methods used to evalua
come distribution effects should all be ap
more often. (See also W71-04271) (Holmes
gers)
W71-04272

EVALUATION OF INTANGIBLES,
New York State Coll. of Agriculture, Ithaca.
of Conservation.
Ronald L. Shelton.
In: Aspects of Planning, Evaluation and Deci
Making in Sport Fishery Management, Depart
of Conservation Extension Series No 1, C
University, May 28, 1968, p 14-17. 1 ref.

Descriptors: Water resource development,
vironmental effects, Cost-benefit analysis, *Ev
tion, *Intangible benefits, Intangible c
Planning.
Identifiers: *Guide to Benefit-Cost Analysis.

A recommendation is made that environmenta
jectives be considered along-side economic ob
tives when resource planning. Three major cri
for evaluating the environmental objectives
stated: uniqueness, diversity, and general healt
proper functioning within the environm
Although environmental benefits are often
sidered to be intangible, the author considers t
environmental objectives 'almost as tangibl
maintaining economic stability.' (See also W
04271) (Holmes-Rutgers)
W71-04273

AN ECOLOGICAL CRITERION EVALUATING AN ENVIRONMENT,
New York State Coll. of Agriculture, Ithaca. D
of Conservation.
Bruce T. Wilkins.
In: Aspects of Planning, Evaluation and Decis
Making in Sport Fishery Management Departm
of Conservation Extension Series No 1, Co
University, May 28, 1968, p 18-23. 2 ref.

escriptors: *Decision-making, *Environmental fects, Resource allocation, New York, Lake Erie, Natural resources, Evaluation.
entifiers: Adirondacks, Forest preserve, Preser-tion of agricultural land.

versity is one of the major criteria in the develop-nt of natural resources. A monoculture is less ble than a complex of organisms–catastrophic ults associated with such things as disease, edators, weather influences, or absence of buffer cies are more likely to occur as diversity inks. It is concluded that society minimized risk maintaining diversity which may have the effect sacrificing maximum productivity. (See also 1-04271) (Holmes-Rutgers)
1-04274

LLUTION PROBLEMS, RESOURCE POLICY D THE SCIENTIST,
w York State Coll. of Agriculture, Ithaca. Dept. Conservation.
red W. Eipper.
e Cornell Plantations, (Research Issue), winter 9-70, Vol 25, No 4, p 51-60. 14 ref.

scriptors: *Water resources development, ecision-making, Water pollution control, New rk, *Water pollution control.
ntifiers: Cayuga Lake.

ic principles of resource management decision-king which apply particularly to water pollution trol problems are outlined. Decisions are public isions and cannot be made unilaterally by any ticular interest group. Conventional economic teria cannot be used as the sole basis for natural ource decisions. Resource managers have an igation to future generations to maintain the lity of natural environment remaining. olmes-Rutgers)
1-04280

GUIDE TO USING INTEREST FACTORS IN ONOMIC ANALYSIS OF WATER PRO-CTS,
reau of Reclamation, Denver, Colo., Engineer-and Research Center.
P. Glenn, and Edmund Barbour.
sale by the Superintendent of Documents, U.S. vernment Printing Office, Washington, D.C. 02. Price $1.50. Water Resources Technical olication, December, 1970. 99 p, 14 tab, 16 fig, ppend.

scriptors: *Government finances, *Interest, scount rate, *Cost-benefit analysis, Economic Risk.

concept of interest as a return for the use of ney requires that values occurring at different nts in time be adjusted to a common basis be-they are compared. The text discusses and nonstrates procedures of deriving economic ivalents through the use of interest and annuity ors and develops interest factors including fac-for uniform increasing and decreasing series of es. Topics covered include interest during con-ction, periods of analysis, stage construction, elopment period factors, the rate of return hod of analysis, capital fixed charge factors, payout schedules. Examples are included for vation of a commercial power rate and a mu-pal and industrial (M and I) water supply rate. omputer solution to a payout problem is also vided. This is an excellent manual for imple-tation of Federal policy; but basic economic stions involved in determining interest and ount rates are not discussed. (Whipple-Rut-)
1-04283

ONOMIC CONSIDERATIONS IN FACILITY ANNING,
erican Water Works Service Co., Inc., Philadel-a, Pa.
mas C. Earl, and Stanley A. Greenstein.

Journal American Water Works Association, Vol 62, No 11, November 1970, p 705-707. 2 fig.

Descriptors: *Public utilities, *Long-term planning, *Decision making, *Economics, Estimating, Methodology, Feasibility studies, Project feasibility, Project planning, Future planning (Projected), Forecasting, Analytical techniques, Cost analysis, Economic feasibility, Evaluation, Financing, Utilities, Planning, Water resources development.

The current period of high interest rates and escalating construction costs requires careful consideration of economic factors during the planning of facility expansion. Population, commercial and industrial growth trends must be studied to determine long-range customer requirements. A comprehensive planning study should result in the most economical method of meeting future customer demands. When two alternative methods of reaching a desired result exist, a present worth analysis may be used to find the most economical one. Utilities usually borrow money to finance capital projects. The cost of this money is the interest which must be paid to the lender. The means of raising funds are different for public and private utilities. These differences affect the interest rates which must be paid, hence, the present worth analyses are affected also. Present worth analyses require the determination of capital requirements for future construction. The method recommended by the authors involves the estimation of construction costs using current data, the preparation of graphs which show annual increases in costs for major items, and the correction of the initial estimate on the basis of information gained from the graphs. Major construction projects may be postponed in the hope that interest rates will drop, but these gains may be more than offset by rising construction costs. (Hewett-Rutgers)
W71-04285

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 03F.
W71-04289

DRY LANDS AND A HUNGRY WORLD,
Oak Ridge National Lab., Tenn.
Gale Young.
New York Academy of Sciences, Transactions, Ser. II, Vol 31, No 2, p 145-187, February 1969. 22 fig, 12 tab, 55 ref.

Descriptors: *Arid lands, *Desalination, *Water costs, *Nuclear power plants, *Cost-benefit analysis, Economic feasibility, Human population, California, Deserts, Irrigation systems, Planning, Nitrogen, Fertilizers, Environmental effects, Numerical analysis, River flow, Valleys, Hydrologic cycle, Cereal crops, Desalination processes, Desalination plants, Crop production, Productivity, Water demand, Distribution, Agriculture, Electric power, Efficiencies, Costs, Industrial plants, Power plants.
Identifiers: *Power costs, *India, *Ganges River Valley, *Developing countries.

The world water budget is reviewed and several major river systems are discussed in detail. Although the world has an enormous amount of water, it is not evenly distributed. The desert land area of the world is far greater than the area of all croplands. The Ganges Plain of India and the San Joaquin Valley in a desert area of California are described and compared in terms of climate, geophysical aspects and current agricultural productivity. The output of the Ganges Plain, relative to its resources, compares unfavorably. An analysis of the problems involved indicates that the factor limiting the conversion from indigenous agriculture to intensive, multi-crop cereal production is not water, soil or sunlight, but power production, which in turn facilitates both N fertilizer production and water transport. Most modern agriculture is essentially petroleum based, but in an underdeveloped, oil-poor country such as India, power production should be based on coal and/or nuclear energy. A detailed budget is worked out for nuclear-powered irrigation water pumping in which crop production is increased sevenfold. The basic production technology and cost structure of nuclear powered desalination are reviewed. Water use efficiency in variou crops and world crop prices are listed. It is argued that in order to achieve an economically feasible agriculture based on nuclear desalination, the number of crops/yr, crop water efficiency, power technology and power costs must all be weighed and coordinated in a careful planning project. (Casey-Arizona)
W71-04291

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
Ohio State Univ., Columbus. Dept. of Economics.
Richard A. Tybout.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana Water Resources Research Center, Purdue, University, p 152-161, 1970. 1 fig, 3 ref.

Descriptors: *Costs, *Economic efficiency, *Decision making, Governments, Compensation, Cost-benefit analysis, Pollution abatement, Water pollution, Standards.
Identifiers: *Social costs, *Private costs, Externalities, Bribery, Inter-industry compensation, Enforced waste ownership, Effluent taxes, Quality standards, Tax credits.

The calculations made in cost-benefit analysis and the private profit calculations are of the same form. In the latter, costs external to the enterprise are not included as the market mechanism does not force the enterprise to do this. One objection to the resulting divergence between social and private costing is the attendant inefficiency. In regard to water pollution, two approaches to internalize social costs have been advanced. These are: legal accountability with inter-industry compensation and bribery. The latter is argued to be impractical. Alternatives available to the Government to decrease the discrepancy between private and social costing are: enforced waste ownership, effluent taxes, quality standards, and tax credits. It may be said that private and social costing lead to rather different decisions in regard to pollution production and abatement. Bringing these calculations in better accord is a complex physical, economic and political problem. It can, however, yield substantial efficiency benefits. (See also W71-03855) (Davis-Chicago)
W71-03863

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03877

EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
Fluor Corp. Ltd., Los Angeles, Calif.
For primary bibliographic entry see Field 03A.
W71-03913

BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
Southern California Metropolitan Water District, San Diego.
For primary bibliographic entry see Field 03A.

W71-03915

BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES: CURRENT ISSUES IN WATER RESOURCES PLANNING,
Bowdoin Coll., Brunswick, Maine; and Wisconsin Univ., Madison.
A. Myrick Freeman, III, and Robert H. Haveman.
Water Resources Research, Vol 6, No 6, p 1533-1539, December 1970. 7 p, 17 ref.

Descriptors: *Benefit-cost analysis, *Water resources development, Public benefits.
Identifiers: Multiple objective planning.

Some basic principles pertinent to a multiple objective planning effort were discussed and both the rationale for the regional development objective and the logical and empirical basis for including some form of regional development in project analysis was considered. Exception was taken to Major's (1969) assertion that we are on the verge of being able to use empirical social welfare functions in public policy analysis. A multiple objective planning problem was said to be an evaluation technique which accomodates both money valued and nonmoney valued effects. Three essentially noncommensurable objectives (national income, regional development, and environmental quality) dealt with by Major were discussed. The use of a regional objective in water resource development was questioned since little is known about the role of water resources investment in regional income charge. This judgement was based on five considerations, which were described in detail. The major criticism to Major's belief that multiple objective public investment planning will lead to discovery of a social welfare function was that it contained a fairly elaborate algebraic and geometric approach to multiple objective benefit-cost criteria without giving sufficient attention to the logical analysis of objectives or the formal aspects of the multiple objective evaluation problem. (Kriss-Cornell)
W71-04023

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: PROGRESS REPORT NO 1,
California Univ., Los Angeles.
For primary bibliographic entry see Field 06A.
W71-04041

ECONOMICS OF THERMAL POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-04084

ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 05D.
W71-04269

CONSTRUCTION COST OUTLOOK - 1970-1971,
James Webber.
Journal American Water Works Association, Vol 62, No 11, November 1970, p 715.

Descriptors: *Construction costs, *Cost trends, Costs, Estimated costs, Inflation (Economic), Economics, Labor supply, Cost comparisons.

Rises in construction costs have far exceeded the expectations of consulting engineers and owners, to the extent that, often, even the lowest bids for jobs exceed the owner's ability to pay. Eighteen to twenty percent increases in construction labor costs have triggered large increases in wages paid to manufacturing employees, and consequently, further price rises are expected. Restrictions on union membership have maintained labor shortages which will severely affect the construction industry in the next few years. Labor productivity is not increasing, and some industrialization of construction will be necessary to offset continuing cost rises. Projects should be designed to be more than just efficient. Bidding should be scheduled to avoid peak bidding periods. Jobs should be widely advertised to insure competition among bidders. Materials should be carefully selected to reduce initial and long-term costs. Capital costs are not likely to drop soon, and waiting until they do will only see compensating rises in construction costs. It is probable that cost inflation will reduce the purchasing power of the construction dollar as much in the first three years of this decade as in the entire decade of the Sixties. (Hewett-Rutgers)
W71-04275

CAN COSTS BE CUT,
Walter B. Sinnot, Joseph D. D'Annunzio, Charles V. Roberts, and Chester A. Ring.
Journal American Water Works Association, Vol 62, No 11, November 1970, p 694-704. 5 tab.

Descriptors: *Construction costs, *Bids, *Induced costs, Contract administration, Planning, Engineers estimates, Economics, Costs, Evaluation, Administration, Cost repayment, Engineering, Design, Construction, Right-of-way.
Identifiers: *Cost reduction.

This paper is a joint discussion by an engineer, a contractor, an equipment supplier and an owner on ways to cut costs during the design and construction of water systems and treatment facilities. The engineer can save money by developing the water supply as a multipurpose impoundment rather than a single purpose impoundment wherever possible, by using the most up-to-date design criteria and technology, and by using functional rather than esthetic materials whenever possible. The bids received for a job may be reduced by lowering the costs a contractor incurs in making a bid, by supplying detailed plans and specifications, and good subsurface data. Things such as rights-of-way, backfilling, concrete finishing, equipment specifications and method of payment can also affect the overall bid by a contractor. Equipment must be chosen to reduce installation, operation, and maintenance costs. Many problems can be avoided and time and money saved by putting out a separate equipment contract. Owners and operators can keep their costs to a minimum by using up-to-date administrative procedures, by using new low-cost materials in construction and maintenance, and by modernizing treatment processes as much as possible. Many utilities waste money by improper planning, and by not planning far enough in advance. (Hewett-Rutgers)
W71-04284

INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 05D.
W71-04286

RECLAMATION IN THE UNITED STATES,
California State. Dept. of Water Resources, Sacramento.
Alfred R. Golze.
Reclamation in the United States, Caldwell, Idaho, Caxton Printers, Ltd., 1961. 486 p, 30 fig, 43 photo, 120 tab, 139 ref.

Descriptors: *Land reclamation, *Federal Reclamation Law, *Reclamation states, *Irrigation, Hydroelectric power, Water allocation (Policy), Federal government, State governments, Federal-state water rights conflicts, Legislation, Administrative agencies, Arid lands, Area redevelopment, Irrigation programs, Economic justification, Legal aspects, Riparian rights, Prior appropriation, basin development, Cost allocation, Cost r ment, Financing, Federal project policy, Mul purpose projects, Operation and maintenance.

Emphasizing both historical background and rent data, this study examines reclamation i United States--as dictated by law and adminis by federal, state, and private agencies. The sco this study is limited to the process of recla western desert land through irrigated agricu supported by coordinated development hydroelectric power. The following areas ar amined: (1) the history of reclamation, (2 economics of reclamation, (3) reclamation law participating agencies, (5) investigation authorization of proposed projects, (6) single pose projects, (7) multiple-purpose projects river basin development, (9) allocations of (10) repayment by water users, (11) repayme power and other users, (12) financing reclam programs, (13) cost estimating, (14) program and accounting, (15) settlement, (16) opera and maintenance, and (17) reclamation in period from 1951 to 1960. Within the area of r mation law, pertinent constitutional and legisl provisions controlling state and federal reclam activity are discussed. The doctrines of prio propriation and riparian law are contrasted examination of the control, distribution, and u water in the 17 western states. The Federal R mation Act of 1902 and other federal legislati considered in terms of federal authority an relationship to state authority. (Earl-Florida)
W71-04306

6D. Water Demand

GEOGRAPHICAL ASPECTS OF THE USE WATER RESOURCES IN THE SOVIET ECO MY,
Akademiya Nauk SSSR, Moscow. Ins Geografii.
For primary bibliographic entry see Field 03F.
W71-04052

INSURING MAXIMUM BENEFICIAL USE WATER THROUGH LEGISLATION,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 06E.
W71-04099

ECONOMIC ANALYSIS OF MARINAS MARYLAND,
Maryland Dept. of Chesapeake Bay Affairs, napolis; and Maryland Univ., College Park. D of Agricultural Economics.
Gale H. Lyon, William B. Matthews, Jr., and De F. Tuthill.
Maryland Agricultural Experiment Station, C tribution No 4100, Report MP 679, April 1969 p, 5 fig, 33 tab, 14 ref.

Descriptors: *Marinas, *Cost analysis, Inc analysis, Economic efficiency, Economies of sc *Maryland, *Recreation facilities.
Identifiers: *Chesapeake Bay, Anne Arun County (Md), Baltimore County (Md), C County (Md).

An analysis was made of the costs, revenues net returns for a sample of limited service marinas in Maryland. The sample was represe tive of the five sizes of marinas in the state. In a tion, an economies of size analysis was made five sized model marinas. The medium si marina, the one accommodating 150 boats, determined to be the most economic, for the la marinas encountered higher per unit costs of la (Holmes-Rutgers)
W71-04267

A STUDY OF WATER USE IN SING DWELLING RESIDENCES IN THE CITY

GARY, ALBERTA, ALBERTA UNIV., ED-
NTON (CANADA),
rto Univ., Edmonton. Dept. of Agricultural
omics and Rural Sociology.
rimary bibliographic entry see Field 03D.
-04287

ERNATIVE CROP ENTERPRISE BUDGETS
IRRIGATED PRODUCTION,
THWESTERN OKLAHOMA,
homa State Univ., Stillwater. Dept. of Agricul-
Economics.
rimary bibliographic entry see Field 03F.
-04294

ER USE IN TENNESSEE, PART D - SUM-
Y,
essee Dept. of Conservation, Nashville. Water
urces; and Geological Survey, Nashville,
M. Wilson, and Alfred M. F. Johnson.
19 p, 8 fig, 9 tab, 24 ref.

riptors: *Tennessee, *Water supply, *Water
ation, *Water demand, Rivers, Streams, Sur-
waters, Groundwater, Water resources, Water
rces development, Natural resources, Legal
ts, Riparian rights, Water requirements,
r users, Human population, Industrial use
er), Hydroelectric power, Aquifers.

narizing the total water use in Tennessee in
this report illustrates through the use of ta-
and graphs the amount of water used, the
es of the water, and the allocation of water
een agricultural, industrial, municipal, and
stic users. Tables are broken down into coun-
county and user-by-user figures. The percent-
f available water withdrawn from each major
basin is also graphed. The report also points
ome legal aspects of water use in Tennessee,
ding the requirement that large quantity users
er with the State Division of Water
urces. Tennessee follows the riparian rights
ine except that, contrary to the general rule,
decision has permitted withdrawal for mu-
l purposes. (Liptak-Florida)
-04324

Water Law and Institutions

LEGAL SYSTEM: STRUCTURE OR CON-
INT FOR SYSTEMS ANALYSIS DECI-
-MAKING,
na Univ., Bloomington. School of Law.
n Tarlock.
atural Resource Systems Models in Decision
ng, Lafayette, Indiana, Water Resources
rch Center, Purdue University, p 179-190,
9 ref.

iptors: *Legal aspects, *Institutional con-
ts, *Decision making, *Water resources
opment planning, Systems analysis.
fiers: *Legal system, Physical system, Public
eering decisions.

are fundamental differences between the
and the physical systems approaches to water
rces development. Legal decisions are
cterized by: concern with past events, con-
with a few parties, the settlement of disputes;
incidental and temporary, unpredictable
s, immediate solutions and indirect long range
ons. In contrast, public engineering decisions
naracterized by: concern with future events,
rn about all parties, the prevention of
es, the optimal and semi-permanent, more
ctable results, deferred solutions, and direct
range solutions. These distinctions are illus-
by considering how the legal and physical
ns affect decisions in three areas: allocation of
resources, drainage and flooding, and en-
mental quality. The fundamental dissimilari-
hat characterize water resources law often provide constraints for the physical and economic system. Yet the interaction of these systems generates changes. On the one hand, legal structures are created conducive to implementing systems analysis solutions. On the other hand, legal developments force incorporation of broader alternatives into physical systems analysis. (See also W71-03855) (Davis-Chicago)
W71-03865

CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
Indiana Univ., Bloomington. Dept. of Political Science.
Vincent Ostrom, and Elinor Ostrom.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue University, p 191-208, 1970. 3 fig, 15 ref.

Descriptors: *Legal aspects, *Political aspects, *Water resources development, *Feasibility, *Decision making, Optimization, Evaluation, Institutions, Planning, Economic feasibility, Financial feasibility, Technical feasibility.
Identifiers: Decision rules, Management systems.

If programs of action in the field of water resource development are to be successful, they have to satisfy technical, economic, financial, legal, and political criteria. Often there is a large array of alternative solutions each producing 'goods' and 'bads' where these terms stand for the broadest possible interpretation of 'benefits' and 'costs'. Maximizing the production of 'goods' is guided by constraints that derive from decision rules of conduct. Law is the prime example of such a set of decision rules. In solving total water resources problems, however, rules become uncertain and the associated politics are a game played under rules that change during the game. Therefore, applied political theory must allow for changes in rules, players, values, and utility functions and their associated probabilities. Water resource decision making involves evaluation of legal and political rules, risks, and opportunities by a team of engineers and lawyers cooperating to suggest needed institutional arrangements. Water resources involve a very complex bundle of goods. Legal relations reflect this, e.g., by the presence of more than one doctrine of water rights. The relation between property right and public authority is particularly relevant in the design of management systems. Such systems often require the institution of new decision rules as condition of long-run political feasibility. The use of a coastal acquifer in Southern California is used as a case study. (See also W71-03855) (Davis-Chicago)
W71-03866

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
Wisconsin Univ., Madison. Dept. of Regional Planning.
Irving K. Fox.
In: Natural Resources Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue University, p 209-221, 1970. 4 fig, 3 ref.

Descriptors: *Institutions, *Water quality, *Systems analysis, *Legal aspects, *Administration, Institutional constraints, Evaluation, Regulation, Economics of scale.
Identifiers: *Water quality management, *Legal-administrative reform, Subsidies.

Relatively recent changes in legal-administrative water arrangements have not yet resulted in conditions under which the systems approach can be properly applied and its decision results implemented. The nature of this problem is illustrated with several examples. Legal-administrative arrangements, conducive to implementing systems analysis results, should incorporate two groups of attributes. The first group includes: (a) technical competence to isolate efficient systems and alternatives; (b) ability to elicit process changes by industry; and (c) capacity to operate joint system components. While at present no agency has all these attributes, they are probably easier to realize than the capabilities of the second group. These include: (a) setting of standards; and (b) evaluating their costs as to magnitude and distribution. The implications of the systems approach for legal-administrative reform are: (a) avoid general subsidies that encourage economies of scale; (b) decrease reliance on regulation of individual discharges; and (c) ascertain the production functions of industries relative to water process changes. (See also W71-03855) (Davis-Chicago)
W71-03867

RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
Cornell (Maurice H.) and Associates, Miami, Fla.

Recommendations Concerning Proposed Legislation To Authorize Water Management Districts in Florida, Department of Water Resources, State of Florida, Nov 1960. 20 p, 3 fig.

Descriptors: *Florida, *Legislation, *Water management (Applied), *Water districts, Local governments, State governments, Federal government, Drainage, Drainage districts, Administrative agencies, Legal aspects, Taxation, Administration, Planning, Regulation, Institutions, Governments, Management.

Recommendations by a commercial engineering firm for legislation authorizing water management districts in Florida, this report emphasizes that: (1) new legislation should be applicable to any state area, (2) local government should have a strong voice in planning and operation, (3) taxation to finance water district operations should be commensurate with the benefit derived, and (4) legislation should not be patterned after that of other states. Specific proposals are made for legislation creating water management districts and sub-districts, and regulating their relations with local government. The purposes, powers, duties, and organization of the proposed districts are included, along with provisions for dealing with federal agencies. Charts illustrate the organizational links between the state and local levels of the proposed water district system. The report's conclusion emphasizes the necessity for carefully drafted legislation to enable Florida to meet its water problems. (Hart-Florida)
W71-03878

WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
West Virginia Center for Appalachian Studies and Development, Morgantown.
Marlyn E. Lugar.
Water Rights Law and Management in West Virginia--Future Needs and Alternatives, Office of Research and Development of the West Virginia Center for Appalachian Studies and Development, West Virginia University, Public Affairs Series No 4 (May 1967). 50 p, 38 ref.

Descriptors: *West Virginia, *Water law, *Water utilization, *Non-structural alternatives, Riparian rights, Water management (Applied), Administration, Legal aspects, Water rights, Water policy, Judicial decisions, Legislation, Prior appropriation, Preferences (Water rights), Regulation, Watershed management, Surface waters, Streams, Watercourses (Legal), Groundwater, Hydrologic cycle, Riparian waters, Riparian land, Future planning (Projected).

Dealing with water rights law and management in West Virginia, this paper: (1) explains why water

shortages may occur in West Virginia, (2) examines the legal rights to the water which is available, and (3) suggests certain changes in the water-use law. It is argued that development of sound principles of law to regulate the use of surface and groundwater must recognize the hydrologic cycle. West Virginia case law has adopted the riparian rights doctrine, but has not applied it to the use of surface water. The paper surveys various aspects of the doctrine as applied to both surface and underground streams, including: (1) uses by riparian owners, (2) uses on riparian tracts, (3) uses by municipalities, (4) rights of riparian owners, (5) what is reasonable use, and (6) investments under the doctrine. The author recognizes a need for watershed management in West Virginia and notes that the existing West Virginia water-use law should be re-examined. A model program is the Huron River Watershed in Michigan. Standards for regulation of water use should be determined by the legislature based on public policy. A major weakness in the current West Virginia law as to water in streams is that it does not fix with certainty the extent of the rights to use water therefrom. (Powell-Florida)
W71-03880

RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
Legislative Research Council of Massachusetts.

Commonwealth of Massachusetts Senate Report No 695, Submitted by the Legislative Research Council Relative to Rights to Surface and Sub-Surface Water in Massachusetts, Feb 13, 1957. 124 p, 7 fig, 6 tab, 20 append.

Descriptors: *Massachusetts, *Water law, *Surface waters, *Subsurface waters, Water rights, Water resources, Riparian rights, Water supply, Groundwater, Water pollution, Floodwater, Navigable waters, Fish, Wildlife, Recreation, Water resources development, Drainage, Water utilization, Rainfall, Administrative agencies, Judicial decisions, Water storage, Industrial water, Public rights.

Prepared by the Legislative Research Council of Massachusetts as a guide to the Water Resources Commission, this report examines: the state of water law in Massachusetts, present and future demands for water supplies, problems of water pollution, and water resources management. The report limits itself to statistical research and fact-finding and does not make recommendations or legislative proposals. Chapter headings include: (1) Water Law in Massachusetts, (2) Riparian Doctrine and Water Resources, (3) Present and Future Water Uses, (4) Industry, (5) Agriculture, (6) Recreation, (7) Hydroelectric Power and Navigation, (8) Flood Control, (9) Pollution, (10) Groundwater, (11) Management Programs in Massachusetts and Other States, and (12) Problems Ahead. Considerable attention is given to water supply, demand, use, consumption and waste. The riparian doctrine receives broad treatment as the basis of Massachusetts water law. There is an examination of case law and legislation in the area of water law and, in an appendix, a digest of leading Massachusetts cases. Attention is also given to various federal and state programs. (Duss-Florida)
W71-03882

IN RE CITY OF YONKERS (CONDEMNATION VALUE OF RIPARIAN LAND).
225 NYS 181 (Sup Ct App Div 1927).

Descriptors: *New York, *Beds under water, *Condemnation, *Compensation, Riparian rights, Riparian land, Eminent domain, Legal aspects, Judicial decisions, Land, Real property, Ownership of beds.

In a condemnation proceeding, the Supreme Court of New York held per curiam that a riparian owner's right to apply for a grant of submerged lands is not 'property' requiring compensation under the constitution. (Hart-Florida)
W71-03883

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
Resources for the Future, Inc, Washington, D.C.
Irving K. Fox.
New Horizons in Water Resources Administration, Resources for the Future, Inc, Washington, DC, April 1965. 8 p, 31 ref.

Descriptors: *Investment, *Administrative agencies, *Water resources development, *Cost-benefit analysis, Federal government, Cost-benefit ratio, Economics, Feasibility studies, Project planning, Cost-benefit theory, Costs, Cost repayment, Cost analysis, Administrative decisions, Interest, Interest rate, Debt, Financing, Financial analysis, Administration, Institutional constraints, Political aspects, Water management (Applied).

Two means of improving administration of water resources are considered in this review: continual evaluation of cost-benefit ratios of water resources projects, and a checks-and-balances framework for administrative agencies to promote efficiency. The author's basic premise is that feasibility of water resources projects depends upon whether benefits exceed costs. He presents six factors to be considered in evaluating water resource investments: (1) the interest required to be paid for public investment; (2) secondary benefits, or those indirectly derived; (3) the difficulty of valuing some development, such as scenery; (4) the range of alternatives other than water to accomplish the desired end; (5) future projections of usefulness of the project; and (6) the multitude of variables influencing the project. Three methods of improving the efficiency of administrative agencies are examined: (1) use of market-like signals as inducement for agencies to act in the public interest; (2) restructure of administrative organization to permit politically responsible administrative action; and (3) use of counter-vailing arrangements to foster efficiency. (Hart-Florida)
W71-03887

MENTELSON V STATE (LIABILITY FOR FLOOD DAMAGE RESULTING FROM STATE'S OBSTRUCTION OF DRAINAGE CHANNEL).
218 App Div 210, 218 NYS 223-229 (Sup Ct App Div 1926).

Descriptors: *New York, *Spoil banks, *Dam failure, *Canal embankments, Flood damage, Dams, Canals, Drainage, Buildings, Walls, Obstruction to flow, Rain, Storm runoff, Surface runoff, Water injury, Adjudication procedure, Legal aspects, Judicial decisions, Damages, State governments, Precipitation excess, Canal construction, Historic flood.

Plaintiff building owner sued defendant state for damages caused by the collapse of plaintiff's building. Defendant had canalized a river, depositing the spoils alongside the river, and the spoilbank obstructed a drainage channel which flowed near plaintiff's building. After an extraordinary but not unprecedented rainfall, which broke a dam upstream from plaintiff's building, flooding caused by the obstructed outlet undermined plaintiff's building. Defendant contended that the breaking of the dam was the proximate cause of the injury. The Supreme Court of New York stated that: (1) defendant had the burden of proving that other causes created plaintiff's loss; (2) defendant's liability was identical to that of an individual; and (3) defendant would be liable notwithstanding the extraordinary character of the flood. Holding that defendant had created a nuisance by erecting the spoil bank, the court adjudged defendant liable for plaintiff's loss. (Hart-Florida)
W71-04018

KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
Kentucky Dept. of Natural Resources, Frankfort.

Kentucky Water Resources - 1965, Commonwealth of Ky, Frankfort, Ky (June 1965). 79 p, 12 fig, 13 map, 9 photo, 19 tab.

Descriptors: *Kentucky, *Water resources, *ministrative agencies, *Legal aspects, State g*ments, Water resources development, Hydr*cycle, Water conservation, Water supply, F*government, United States, Legislation, J*decisions, Local governments, Water re*ments, Surface waters, Surface-groundwate*tionships, Groundwater, Surface runoff, *quality, Water utilization, Climatic data, *pollution.

Current information relating to the status o*tucky's water resources is presented in this r*It is divided into eight chapters: (1) climat*population, (3) water use, (4) water quali*surface water, (6) groundwater, (7) water *and regulatory laws, and (8) existing prograr*administration. Chapter 7 discusses: (1) th*stitutional origin of the development of Ken*water resources, (2) case law on water righ*state regulatory authorities, and (4) federal r*tory authorities. In Chapter 8 state departme*volved in water resources managemen*discussed, including: (1) the Departments of*ral Resources; (2) the Division of Flood C*and Water Resources Development; (3) the*Mining and Reclamation Commission; (4) the*sion of Forestry; (5) the Division of Soil and *Resources; (6) the Division of Cleanup and *tification; (7) the Department of Fish and W*Resources; (8) the Department of Parks; (*Department of Public Safety; (10) the Depar*of Health; (11) the Kentucky Geological S*(12) the Department of Mines and Minerals*the Water Resources Institute; and (14) th*partment of Commerce. Activities of state b*districts, political subdivisions, interstate age*US government agencies, and private organiz*are also examined in Chapter 8. (Hart-Florida
W71-04021

PRINCIPLES OF WATER RIGHTS LA*OHIO,
Ohio Dept. of Natural Resources, Columbus*of Water.
Charles C. Callahan.
August, 1959. 34 p, 2 chart, 299 ref.

Descriptors: *Ohio, *Preferences (Water ri*, *Water law, *Water rights, Judicial deci*Legal aspects, Surface-groundwater relation*Surface waters, Surface runoff, Percolating *Underground streams, Subsurface flow, Wate*lution, Riparian land, Riparian waters, Cons*tive uses, Diversion losses, Reasonable use, F*water, Drainage water, Civil law, Irrigation, U*seepage, Legislation, Groundwater.

The legal classifications, general theories, an*ture of the problems existing in Ohio water la*examined in this study. Water rights la*discussed from the vantage point of judicial *sions rather than specific legislative provisions*doctrine of riparian rights, water uses, altern*dispositions of water, and water pollution are*sidered in their relationship to streams and r*Diffused surface water is studied in its relatio*to other waters, its possible uses, and the legal*sequences created by varying types of su*water. Legal aspects of underground water*plies, including both percolating water and*derground streams, are discussed by the auth*terms of the consequences of malicious *negligence, subsidence of surface areas, decre*streamflow, and pollution. Specific doctrines*sidered in the work include: (1) prior appro*tion, (2) riparian rights, (3) natural flow,*reasonable use, (5) common enemy, and (6)*law. (Earl-Florida)
W71-04022

THE DOCTRINE OF CONSEQUENTIAL D*AS AFFECTED BY VALUATION FORMULA
Robert P. Schuster.
Land and Water Law Review, Vol 4, No 2, p*557, 1969. 19 p, 57 ref.

escriptors: *Condemnation value, *Eminent main, *Condemnation, *Damages, Land appraisal, Land, Real property, Governments, Legal pects, Judicial decisions, Economics, Land use, nd resources, Urbanization, Cost analysis, Anals, Appraisals, Costs, Evaluation, Benefits, Cost ocation, Value, Compensation, Economic imct.

e author of this comment advocates restricting doctrine of consequential loss, a doctrine which nies compensation to a condemnee for the taking rights so remote as to be incidental to the conmnation of physical property. The elements verning compensability in condemnation ceedings are stated to be: (1) property; (2) tak; and (3) just compensation. As any one of these ments becomes more loosely defined, those inces in which the doctrine may be imposed ome fewer. The concept of 'taking' has become ad enough that land flooded by a dam may be nd to have been appropriated, requiring comsation. Attention is given the legal development the doctrine and the equitable considerations igating for its restriction. Special emphasis is ced on the land use considerations suggesting riction of the doctrine. The author contends a doctrine of compensation for only what is sically taken, rather than what the condemnee ually uses, leads to inefficient land use. The nor proposes that more protection be afforded expectations and reliance interests of connees. (Dye-Florida)
1-04031

RCORAN V VILLAGE OF BENNINGTON GHT TO WATER AND SEWER SERVICE RMITS).

A2d 457-466 (Vt 1970).

criptors: *Vermont, *Water permits, *Zoning, rmits, Land use, Water delivery, Sewers, Local ernments, Administrative decisions, Public ts, Land tenure, Real property, Legislation, Jual decisions, Legal aspects, Land classification, d development.
tifiers: Injunction (Mandatory).

ntiff mobile-home subdivision owner sought to pel defendant village authorities to issue per for water and sewer service. Defendants had d to act on plaintiff's application for several s. Plaintiff contended he was entitled to the nits applied for plus a court order requiring the re issuance of such permits, notwithstanding a ng ordinance enacted subsequent to his appli n and excluding mobile-home subdivisions. ndants, relying on an earlier zoning ordinance h also barred such subdivisions, contended their refusal to act was within their discretionowers. Stating that sewer and water services are tter of right which may not be used as zoning uments, the court held that mobile home subion owners are entitled to sewer and water serunder the same terms and conditions as other ents. After finding invalid the zoning orce in effect at the time of plaintiff's applicathe court ordered defendants to grant the per previously applied for. However, the court ed to compel the issuance of future permits such permits are subject to reasonable regula, and the court would not prejudge defendants' ns in imposing such regulations. (Earlda)
-04071

RAULIC RACE CO V GREENE (INPRETATION OF LEASE PROVIDING FOR OF ALL SURPLUS WATERS OF CANAL).

App Div 374, 245 NYS 444-461 (Sup Ct).

riptors: *New York, *Leases, *Contracts, ials, Industries, Legal aspects, Judicial deci, Water rights, Adjudication procedure, Rela rights, State governments, Governments, Water contracts, New York State Barge Canal, Transportation, Water sources, Channel flow, Navigation.
Identifiers: Patents (Land).

The state leased to plaintiff waters of the Erie Canal under a contract which allowed plaintiff the use of all waters of the canal not needed by the state for navigation. Defendant superintendent of public works sought to interfere with plaintiff's use of the waters, contending that the maximum quantity of water leased to plaintiff was that amount not necessary for navigation at the time of the execution of the contract. Plaintiff sought to restrain defendant's interference. The Supreme Court of New York reversed an official referee's judgment for defendant. Contracts for consideration, involving the state as lessor of surplus canal waters, should be construed favorably to the patentee. Effect must be given to the mutual intent of the parties. In this case the contract leased all waters not necessary for navigation, not merely surplus waters existing at the time of the contract's execution. When enlargement of the canal increased the surplus, plaintiff was entitled under the lease to the entire surplus amount. (Dye-Florida)
W71-04074

WYKLE V COLOMBO (APPORTIONMENT OF ACCRETIONS BETWEEN ADJACENT RIPARIAN OWNERS).

457 SW2d 695-701 (Mo 1970).

Descriptors: *Missouri, *Accretion (Legal aspects), *Boundary disputes, *Adjudication procedure, Boundaries (Property), Riparian land, Rivers, Navigable rivers, Navigable waters, Banks, Riparian waters, Land tenure, Real property, Prescriptive rights, Docks, Recreation facilities, Legal aspects, Judicial decisions, Surveys, Mapping.

Plaintiff riparian owner brought action against adjacent riparian owner to establish title by adverse possession to certain land to which defendant held record title. Affirming a judgment for defendant, the Supreme Court of Missouri noted that the trial court was correct in not partitioning the land formed by accretion along the river bed bounding the property of the parties. The court held that plaintiff's petitions and exhibits contained insufficient information to enable the trial court to properly determine the boundaries and to apportion the accreted land between the adjoining riparian owners. (Liptak-Florida)
W71-04078

POWER OF CITIES AND TOWNS TO PROVIDE DRAINAGE AND SEWAGE FACILITIES.
Iowa Code Ann secs 368.26, 368.43 thru 368.46 (Supp 1969).

Descriptors: *Iowa, *Cities, *Drainage systems, *Sewage disposal, Public health, Sewage, Sewage treatment, Drains, Surface waters, Drainage, Surface drainage, Contracts, Legislation, Assessment, Floodwater, Local governments, Government finance, Supervisory control (Power), Sewage districts.

Governments of cities and towns shall have the power to provide drainage systems for flood and other surface waters and to regulate connection of private drains thereto. Municipalities may order connections from private property when public health and safety require and may have such works done if their order is not complied with. Municipal governments shall also have the power to provide sewer systems and sewage disposal plants, and may regulate sewer connections to private property. They may order installation of sanitary toilet facilities on property abutting a sewer line, and may cause the work to be done and assess costs if their orders were not complied with. Also included are provisions regarding extension of sewer systems and powers of cities to enter into contracts with sewage disposal operators outside corporate limits. All cities with populations of more than 100,000, through which a stream flows furnishing drainage for any adjoining cities upstream, shall have the power to construct the drains and sewers necessary to protect the public health. Various procedural sections are included, outlining procedures to be complied with in the construction of sewers and establishment of sewer districts. (Duss-Florida)
W71-04081

THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
J. W. Thursby.
Address, Southern Water Resources Conference, 15th Meeting, Tulsa, July 16-18, 1969, p 11-19. Council of State Governments, Atlanta, Ga. Southern Office.

Descriptors: *Delaware River Basin Commission, *Water resources development, *River basin development, *Interstate compacts, Water utilization, Delaware River, Interstate rivers, Delaware, New York, New Jersey, Pennsylvania, Conservation, Governments, Interstate commissions, Nonstructural alternatives, Project purposes, Water conservation, Water policy, Water supply, Water pollution control, Watershed management, Public utilities, Recreation facilities, Reservoirs, Flood control.

Presented at a meeting of the Southern Water Resources Conference, this address outlines the authority, responsibilities, duties, administrative arrangements, results, and continuing problems of the Delaware River Basin Commission. The Commission is responsible for water resource development in the Delaware River basin and was created by the Delaware River Basin Compact signed by Delaware, New York, New Jersey, and Pennsylvania. After outlining the background, organization, and operations of the Commission, the text discusses program successes in the areas of: water supply, in incorporating storage and flow control facilities, in water quality, and in setting waste discharge standards for river zones and individual dischargers. The speaker briefly mentions problems and projects relating to flood control, watershed management, recreation facilities, rehabilitation of fish and wildlife resources, and promotion of hydroelectric power resources. The text concludes that the interstate compact is an effective approach to water resources development because of its broad scope and powers. The need for additional legislation to deal with particular problem areas is cited. (Liptak-Florida)
W71-04089

THE PROPOSED POTOMAC RIVER BASIN COMPACT,
Julian M. Alexander.
Address, Southern Water Resources Conference, 15th Meeting, Tulsa, July 16-18, 1969, p 5-10. Council of State Governments, Atlanta, Ga. Southern Office.

Descriptors: *River basin commissions, *Water resources development, *River basin development, *Interstate commissions, Water utilization, Legislation, Water pollution control, Water quality control, Flood protection, Administration, Administrative agencies, Coordination, Project planning, Legal aspects, Adjudication procedure, Maryland, Virginia, West Virginia, Pennsylvania, District of Columbia, Watershed management, Multiple-purpose projects, Water policy, Water supply, Interstate compacts.
Identifiers: *Potomac River Basin Commission.

Presented at a meeting of the Southern Water Resources Conference, this address outlines the organization, powers, and purposes of the proposed Potomac River Basin Commission. The Commission is to be created by an interstate compact to be

signed by Maryland, Virginia, West Virginia, Pennsylvania, and the District of Columbia. The basin-wide commission would cooperate with and coordinate the individual agencies already responsible for pollution abatement, flood prevention, watershed management, scenic and recreational development, and water supply. The text outlines the problems and responsibilities of the proposed Commission in each of these areas. The Commission will have authority for research and planning, but actual implementation and construction will be left to the already existing agencies under Commission coordination and supervision. The author points out that the commission will be accountable to the public and its actions subject to judicial review. (Liptak-Florida)
W71-04090

THE POLITICS OF WATER,
Council of state Governments, Atlanta, Ga. Southern Office.
Tom Adams.
Address, Southern Water Resources Conference, 14th Meeting, Miami Beach, July 31-Aug 2, 1968, p 16-19.

Descriptors: *Political aspects, *Water resources development, *Non-structural alternatives, *Water allocation (Policy), Governments, Inter-agency cooperation, Planning, Government finance, Water policy, Legislation, Regulation, Water Resources Research Act, Flood control, Water conservation, Water utilization, Water supply, Inter-basin transfers, Interstate commissions, Water Resources Planning Act.

Presented at a meeting of the Southern Water Resources Conference, this speech distinguishes between two types of water problems: (1) practical problems, technical solutions to specific problems; and (2) political problems, generation of public interest and financing to implement the practical solutions. The author considers the three most pressing political problems to be: (1) comprehensive state and interstate water resources inventory and planning, (2) inter-basin transfer of water supplies, and (3) regulation of water use to guarantee equal access to the available water supply. The text concludes that all of these problems are within present technological capabilities, but that none can be solved without political and public support for the financial and administrative programs necessary to implement the available technology. (Liptak-Florida)
W71-04091

A NATIONAL POLICY FOR THE ENVIRONMENT: SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91st CONGRESS. 1st SESSION.
Library of Congress, Washington, D.C. Legislative Reference Service.

Part I, December 1969. 156 p; Part II, January 1970. 24 p. TP450.

Descriptors: *Federal government, *Environment, *Legislation, *Federal project policy, Conservation, Administrative agencies, Ecology, Environmental effects, Natural resources, Wildlife, Aquatic life, Water supply, Water pollution, Pollution abatement, Air pollution, Oceans, Water policy, Public health, Beneficial use, Fresh water, Waste disposal, Balance of nature, Administration, Leadership, Research and development.
Identifiers: *National Environmental Policy Act.

Tracing the history of the National Environmental Policy Act of 1969, these selected excerpts from the Congressional Record and from congressional documents include: (1) debate on Senate Bill 1075, to establish a national policy for the environment; (2) debate on Senate Bill 7, to amend the Federal Pollution Control Act; (3) debate on House Resolution 12549, to amend the Fish and Wildlife Coordination Act for establishment of a Council on Environmental Quality; (4) Senate Report 91-296 accompanying Senate Bill 1075; (5) debate on the Conference Report on Senate Bill 1075; and (6) Public Law 91-190, the National Environmental Policy Act of 1969. The overriding concern of the debates was the use of environmental management to bring about improvement in the quality of the environment. The existing governmental organizations were seen as inadequate to cope with the complexity of environmental problems, thus creating a need for a national policy and a council on Environmental Quality. Prominent consideration was given to research and investigations into: ecological systems, natural resources, and the quality of the environment. (Duss-Florida)
W71-04092

DELAWARE RIVER BASIN COMPACT.

Delaware River Basin Commission, Trenton, January 1967. 51 p, 1 map.

Descriptors: *Delaware River Basin Commission, *Delaware River, *Interstate compacts, *Water resources development, United States, Pennsylvania, Delaware, New York, New Jersey, Legislation, Interstate rivers, Interstate commissions, navigable rivers, Riparian rights, Hydroelectric power, Federal government, State governments, Administrative agencies, Water pollution, Flood protection, Watersheds, Watershed management, Taxes, Water pollution control.

The Delaware River Basin Compact of 1961 between Delaware, New Jersey, Pennsylvania, New York and the United States is supervised by the Delaware River Basin Commission. The purpose of the Compact is to provide for cooperation among the signatory states in developing and utilizing the water resources of the Delaware River. Article 2 creates the commission and establishes its composition, procedures, and jurisdiction. The Commission's power and duties are promulgated in Article 3. Article 4 authorizes the Commission to supervise water supply from the Delaware. Provisions are made for storage, release of waters, and assessable improvements. The Commission also is given full power over: (1) pollution control, (2) flood protection, (3) watershed management, (4) recreation, (5) hydroelectric power, and (6) withdrawals and diversions. Article II provides for intergovernmental relations. Other articles provide for capital financing, plans, programs, and budgets. General provisions for such things as tax exemptions, oaths of office, insurance, condemnation proceedings, tort liability, and riparian rights are promulgated in Article 14. Part II of the Compact deals with effectuation and publishes the ratifying acts of the legislatures of the signatory states. (Hart-Florida)
W71-04093

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
New Jersey Department of Conservation and Economic Development, Trenton, 1958. 28 p, 7 plate.

Descriptors: *New Jersey, *Dams, *Legislation, *Permits, Administrative agencies, Dam construction, Dam design, Dam foundations, Earth dams, Damsites, Design flood, Spillways, Hydrologic data, State governments, Legal aspects, Engineering, Engineering structures, Governments, Administration.

Information required for dam building and repair in New Jersey is furnished by this pamphlet. The New Jersey statutes pertaining to dams and obtaining permits to construct or repair dams are set forth in full at the beginning. The statutes are followed by general information for applicants, stating that the following data must accompany each application: (1) location plan, (2) general site plan, (3) engineering report, (4) construction drawings, and (5) technical specifications. The engineering report requirements are next set forth in detail followed by a guide outline for site investigatio order to make a rational determination o required spillway capacity, the type, design cr for them are suggested. The pamphlet list describes the usual types of spillways utiliz New Jersey: (1) overfall, (2) ogee, (3) chut auxiliary, and (5) siphon or gated. A formu calculating the discharge capacity of a spill provided. Further information includes: requirements for drawings submitted with ap tions, (2) standard conditions to which all pe are subject, and (3) a series of specimen dra (Hart-Florida)
W71-04094

RIPARIAN AND LITTORAL RIGHTS; A VEY OF SOME OF THE LEGAL PROBL INVOLVED IN RESIDENTIAL AND COM CIAL USES ALONG THE WATER'S EDG RELATION TO THE SUBSTANTIVE ASP OF PUBLIC POLICY,
Carroll Dunscombe.
William-Frederick Press, New York, 1970. 84 ref.

Descriptors: *Riparian land, *Riparian rights, toral, *Land use, Rivers and Harbors Act, merged Lands Act, Water law, Federal go ment, United States, Prescriptive rights, Dive Navigation, Relative rights, Remedies, Wate lution, Drainage, Islands, Competing uses, Oc Gulfs, Fishing, Swimming, Accretion (aspects), State governments, Florida, aspects.

Since the average riparian or littoral owne only a vague idea of his property rights and wh may do without encountering legal difficulties book endeavors to delineate these rights an dicate the rights to which they may be subject toral property is distinguished from riparian la its location on an ocean or gulf. In this survey legal difficulties of riparian and littoral land both residential and commercial, subdiv discuss: (1) source of the riparian right; (2) na extent, and basis of the right; (3) property to rights attach; (4) deprivation of naviga through water diversion; (5) reducing the rig possession; (6) islands; (7) loss of the rip right; (8) adverse possession; (9) extent of the to view; (10) pollution; (11) the public's rig fish and bathe; (12) the right of navigation; the Rivers and Harbors Act; (14) drainage; trespass on the right; (16) prescriptive rights; accretion and reliction; (18) state control; Florida attempts to revoke the riparian right (20) federal control; (21) water conservatio tricts; and (22) the Tidelands decision and the merged Lands Act. (Hart-Florida)
W71-04095

ACTIVITIES OF THE FEDERAL WATER LUTION CONTROL ADMINISTRATI WATER QUALITY STANDARDS.
Hearings--Subcomm On Air and Water Pollu Comm on Public Works, US Senate, 90th gress, 2nd Session, Mar 27, 1968. 296 p, 5 map, 11 photo, 47 ref, 4 append.

Descriptors: *Adminstrative agencies, *W Quality Act, *Water quality, Federal governm Standards, Water pollution, Water pollution trol, Water quality control, Administra Legislation, Water policy, State governm Wastes, Waste treatment, Effluents, Estu Costs, Cost analysis, Manpower, Techno Sewage treatment, Municipal wastes, Indu wastes, Management, Financing.
Identifiers: *Federal Water Pollution Control

The Senate Subcommittee on Air and Water P tion held these hearings on the activities o Federal Water Pollution Control Administr (FWPCA) in the area of water quality stand The purpose of the hearings was to pr background for future hearings on pending le tive proposals. Existing legislation involved i

nsideration of FWPCA activities included: (1) e Water Quality Act of 1965, which created the WPCA; (2) the Clean Water Restoration Act of 966; and (3) the Federal Water Pollution Control ct. Members of the Department of the Interior ere the principal witnesses testifying before the bcommittee. The basic duty of the FWPCA is the otection and restoration of the nation's waters. inciples governing the Administration's review of ater quality standards are discussed. The most sigficant objective of the Administration is preventg degradation of existing water quality. Other eas receiving attention include: (1) construction ants for waste treatment works, (2) cost studies waste treatment facilities, (3) manpower and ining requirements to carry out programs, (4) forcement of water quality standards, and (5) llution of estuaries. A state-by-state analysis of nd issues for sewer and waste treatment facilities ncluded, as is an article on municipal sewer ser-e charges. Appendixes outline state water qualistandards and FWPCA activities. (Duss-Florida)
71-04096

IE LAND AND WATER CONSERVATION ND ACT: DEVELOPMENT AND IMPACT,
ntral Washington State Coll., Ellensburg. Dept. Geography.
nneth A. Hammond.
69. 249 p, 13 tab, 174 ref. OWRR Project B-9-WASH (2).

scriptors: *Recreation demand, *Legislation, ater allocation (Policy), *Federal project pol-, Federal jurisdiction, State jurisdiction, Federal vernment, State government, Land classifica-n, Administrative decisions, Inter-agency peration, Administrative agencies, Adoption of ctices, Project purposes, Political constraints, titutional constraints, Washington, Political ects, Economic impact, Recreational facilities, gal aspects, Land use, Water resources, Social pact, Water conservation.
ntifiers: *Land and Water Conservation Fund t of 1965.

cusing on the Land and Water Conservation nd Act of 1965, this study compares the congresnal decisions to commit land and water ources to specified use patterns to the results in t achieved by such legislation. The evolution, pact, and future significance of the LWCP Act erience are evaluated through an analysis of: intergovernmental and organizational relationps, (2) decision-making processes, and (3) nomic and political realities. Part I of the study siders the federal response to those public reational preferences which resulted in the CF. Part II examines the response of states to LWCF program. The state of Washington's atpts to meet public recreational demands, the innce of the LWCF on Washington's programs, the role of state agencies, policies, and cedures are discussed in Part III. In Part IV, mon factors in the state and federal experience the LWCF are considered in terms of program ctives and operating methods. Also considered such problems as: financing, zoning, assessnt, easements, planning, staffing, taxing, federale division of revenues, and appropriations in the of resource policy. (Earl-Florida)
1-04097

VELOPMENT OF OCEAN SPACE--AN IN-RNATIONAL DILEMMA,
id Pardo.
isiana Law Review, Vol 31, No 1, p 45-72, 0. 28 p, 32 ref.

criptors: *Oceans, *International law, *Natural urces, *Law of the sea, Beds, Legal aspects, Inational waters, Commercial fishing, United Nas, Governments, Foreign waters, Foreign coun-, United States, Conservation, Beds under r, Regimes, Ownership of beds, Boundaries perty), Continental shelf, Water pollution, ution abatement, Water pollution control, -structural alternatives, Relative rights.

Identifiers: *Ocean resources.

Discussing the problem of controlling the depletion of the natural resources of the high seas, this article points to increasing pollution and fish stock depletion as examples of the fallacy in the existing international law philosophy, that is, that the seas' resources are inexhaustible. The present law says nothing about the seabed other than the continental shelf itself. The author proposes a shift of emphasis in international law from settling internation disputes to establishing guidelines for the protection and development of the oceans' resources. He suggests an independent international agency to serve as trustee of the oceans' resources and to allocate and manage development rights in the ocean floor. The author also discusses the difficulties in obtaining United Nations action, specifically the failure to agree on basic legal principles governing exploitation of the sea beds. The difficulty centers on the failure to agree on three basic questions: (1) the basic concept, whether to retain the idea of the freedom of the high seas or to adopt a common heritage-public trust approach; (2) the nature of the international regime, whether its competence should be limited to specific resources or extended to control of all ocean uses; and (3) the definition of the limits of national jurisdiction. The author concludes that early action is vital since the oceans' resources continue to be depleted while coastal states haggle over national objectives. (Liptak-Florida)
W71-04098

INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
Kansas Univ., Lawrence.
H. E. Thomas.
In: Transactions of the Sixth Annual Conference on Sanitary Engineering, p 13-22, University of Kansas, Lawrence, Kansas, 1956. 10 p, 1 map.

Descriptors: *Legislation, *Beneficial use, *State governments, *Water resources development, Consumptive use, Domestic water, Non-consumptive use, Preferences (Water rights), Prior appropriation, Administrative agencies, Legal aspects, Priorities, Reasonable use, Remedies, Surplus water, Unappropriated water, Water sources, Water utilization, Proration, Riparian rights, Relative rights, Riparian waters, Severance, Prescriptive rights, Natural use.

The overall hydrologic pattern of the United States is categorized by this article into geographic areas with: (1) water deficiency; (2) water surplus; and (3) winter surplus and summer deficiency. Regulation and development of water use, encouragement of use modifications which will most benefit society, and protection of established rights and opportunities to develop water are cited as recommended objectives of legislation. The following problems for state legislation are examined: (1) limitation of rights, (2) protection of rights, (3) recording water rights, (4) authority and responsibility of the administrator, (5) policy guides for the administrator, (6) preferential use vis-a-vis priority of use, and (7) reservoir regulation. The author notes three doctrines for limiting water rights: (1) correlative, (2) mutual prescription, and (3) appropriation. Since preferential use and priority of use are both potentially controlling factors in determining water rights, it is observed that a state, in order to prevent confusion, should determine which doctrine prevails. The author concludes that legislation developing beneficial use should: (1) clearly define water rights, (2) provide broad authority and policies for the administrator, (3) utilize scientific study as a basis, and (4) encourage local responsibility for developing water resources. (Hart-Florida)
W71-04099

CONTINENTAL SHELF LAW: OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
Jean T. Drew.
Louisiana Law Review, Vol 31, No 1, p 108-120, 1970. 13 p, 71 ref.

Descriptors: *Continental shelf, *International law, *Natural resources, *Technology, Law of the sea, International waters, Regimes, Oceans, Treaties, Continental margin, Continental slope, Coasts, Beds, Beds under water, Ownership of beds, Boundaries (Property), Conservation, Resource development, Governments, Regulation, Legislation, Legal aspects, Jurisdiction, Non-structural alternatives.

Examining the need for changes in the national and international law governing the continental shelf, this article points out the variance between the geological and legal definitions of the shelf. Newly developed and emerging uses of the shelf are discussed, and the development of present law is traced through the Truman Proclamation, the United Nations Convention on the Continental Shelf, and the Outer Continenetal Shelf Lands Act. Implications of United States v Ray, 423 F.2d 16 (5th Circ. 1970), are examined, including the uncertainty created, in coastal state's rights in the shelf, by new uses. The major defect of the present law is that it is limited to defining the coastal states' rights in the shelf's natural resources while new technology has made possible new uses of the shelf for transportation, defense, recreation, research, and even residential housing. The author concludes that this new technology demands that laws be revised or devised to insure coastal state adequate authority to pursue and govern all reasonable uses of the continental shelf. (Liptak-Florida)
W71-04100

WATER QUALITY CONTROL: A MODERN APPROACH TO STATE REGULATION,
Frank E. Maloney, and Richard Ausness.
Albany Law Review, Vol 35, No 1, p 28-59, 1970. 32 p, 131 ref.

Descriptors: *Water resources development, *Administration, *Water quality control, *Legislation, Water utilization, Administrative agencies, Planning, Abatement, Water pollution control, Water quality, Institutions, Water conservation, Water resources, Water Resources Research Act, Regulation, Permits, Non-structural alternatives, Standards, Legal aspects, Jurisdiction, Remedies, Administrative agencies, Supervisory control (Power).
Identifiers: *Model Water Codes.

Presenting chapter 5 of a six-chapter Model Water Code drafted at the University of Florida, this law review article sets forth a suggested state program for water quality control. The text of chapter 5 of the Code is provided, followed by a commentary on the origin and purpose of each section. After defining the usage of terms such as water quality, impairment of water quality, pollution, and wastes, the Code authorizes a State Water Resources Board to adopt and administer a water quality program. The program consists of classifying the state's waters, setting water quality standards, adopting a comprehensive plan, and providing for review and revision of the plan and thestandards. Local governing boards will issue permits for construction or operation of facilities affecting water quality, carry out inspections, and order abatement of violations of the standards. The Code also provides for jurisdiction for the local boards to seek injunctive relief against violators. The authors point out that the failure of prior efforts at state-wide water-quality programs stems from the tendency to provide legal authority without the financial support necessary for enforcement. (Liptak-Florida)
W71-04101

FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
James T. B. Tripp, and Richard M. Hall.
Albany Law Review, Vol 35, No 1, p 60-80, 1970. 21 p, 78 ref.

Descriptors: *Rivers and Harbors Act, *Water pollution control, *Navigable waters, *Remedies, Wastes, Legislation, Judicial decisions, Rivers, Industrial wastes, Domestic wastes, Municipal

wastes, Oil wastes, Sewage, Waste water (Pollution), Pollutants, Water pollution, Water pollution sources, Pollution abatement, Water quality control, Waste disposal, Waste water disposal, Legal aspects, Regulation, Permits.
Identifiers: *Refuse Act.

Noting that old, under-utilized statutes may be applied to present problems, this article discusses the proscriptions and remedies provided by the Refuse Act of 1899, originally known as the Rivers and Harbors Appropriation Act of 1899. That act prohibits the discharge of any refuse into any navigable waters and provides for civil and criminal remedies. The authors discuss the Act in context with other sections of the Rivers and Harbors Act which also promote the protection of the nation's navigable waters. The article analyzes the judicial interpretations of the following terms and phrases: (1) 'refuse' (2) 'other than that flowing from streets and sewers and passing therefrom in a liquid state,' (3) 'suffer to be deposited,' (4) 'deposit,' (5) 'the bank of any navigable water,' and (6) 'impeding navigation.' Also examined is the requirement of scienter under the Act. The article also outlines the available criminal and civil remedies and discusses the procedures for obtaining injunctive relief against a polluter. The authors conclude that many questions of interpretation, notably whether a private right of action exists, await further cases to be resolved. (Liptak-Florida)
W71-04102

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS: 1966 STATISTICAL SUPPLEMENT.
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 09D.
W71-04103

WATERSHED PROJECTS.

Hearings--Subcomm On Conservation and Credit, Comm On Agriculture--US House of Representatives, 90th Congress, 2nd Session, Jan 22, 23, July 9, 10, 11, 15, Oct 9, 1968. 202 p.

Descriptors: *Watershed management, *Water resources development, *Cost-benefit analysis, *Legislation, Project planning, Project benefits, Multiple-purpose projects, Water policy, Agricultural watersheds, Water conservation, Soil conservation, Flood protection, Administrative agencies, Federal government, Flood control, Recreation facilities, Drainage, Surface waters, Runoff, Costs, Rainfall, Water storage, Land management, Reservoirs, Reservoir operation.

Hearings were held before the House Subcommittee on Conservation and Credit of the Committee on Agriculture to discuss various proposed watershed projects throughout the United States. The Subcommittee discussed proposed projects located in: South Carolina, Wisconsin, California, Alabama, Florida, Louisiana, Colorado, Arkansas, Kansas, Texas, Indiana, West Virginia, Oklahoma, Idaho, North Carolina, South Dakota, North Dakota, Virginia, Georgia, Iowa, and Kentucky. Of prime interest to the Subcommittee were the cost-benefit ratios of projects, the size of the area benefited, and the number of beneficiaries. Most projected benefits were agricultural. However, urban, transportation, and recreational benefits were frequent. Discussion also centered on the proposed watershed structures, the areas' past experience with flooding, and their history of flood damage. Funding of the project was to come from both federal and local funds. The relative value of each project was important since not all of the proposed projects could be funded from available appropriations. (Duss-Florida)
W71-04104

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
Federal Council for Science and Technology, Washington, D.C.

Report to the President on Water Resources Research, Senate Comm on Interior and Insular Affairs, 88th Cong, 1st Sess, March 1963. 213 p, 50 tab, 45 ref.

Descriptors: *Scientific personnel, *Federal government, *Water resources development, *Research and development, Water policy, Water resources, Water supply, Water quality, Hydrologic cycle, Groundwater, Streams, Weather, Water pollution, Environment, Administration, Administrative agencies, Costs, Streamflow, Manpower, Education, Training, Universities, Grants, Projects, Water demand, Water reuse.

The Federal Council for Science and Technology prepared this report on water resources research to provide: (1) policy guidance for federal agencies participating in research and (2) a basis for a coordinated scientific research program on water. An initial summary outlines the Report's findings and conclusions. Chapter I discusses the need for water research, centering on increased water demand in the future and the value of planning for more efficient use of water resources. Chapters 2 and 3 discuss the federal government's responsibilities for water resources research and the responsibilities of specific agencies. Chapter 4 discusses technical problems and research programs. Topics include: (1) the nature of water, (2) the water cycle, (3) water in relation to land management, (4) water resources development and control, (5) water quality, (6) water reuse, (7) economic and institutional aspects of water resources, (8) engineering systems for water resources development, and (9) manpower and research facilities. Estimated costs of various programs are provided. Chapter 5 gives a program summary and evaluation. Chapter 6 discusses the manpower necessary to carry on adequate research, and chapter 7 discusses coordination of the research activities of various federal agencies. Chapter 8 outlines legislative aspects which center on assuring a continued flow of competent manpower for research activities. (Duss-Florida)
W71-04105

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
Edmund S. Muskie.
Maine Law Review, Vol 22, No 1, p 171-187, 1970. 16 p, 54 ref.

Descriptors: *Federal jurisdiction, *Institutional constraints, *Legislation, *Political aspects, Coordination, Legal aspects, Administrative agencies, Administrative decisions, Non-structural alternatives, Water Quality Act, Water pollution control, Water resources development, Thermal pollution, Impaired water quality, Dredging, Landfills, Pollutants, Jurisdiction, Federal government, Nuclear powerplants, Hydroelectric plants.
Identifiers: Water Restoration Act.

This article examines the scope of, conflicts within, and proposed improvements in federal environmental jurisdiction. The centers of congressional jurisdiction over such areas as thermal pollution, hydroelectric plant location and effects, water pollution, dredging, the filling of wetlands, continental shelf oil leasing, and landfill in harbors and estuaries are described. The article sets forth congressional committees responsible for legislation such as the Water Quality Act of 1965 and the Clean Waters Restoration Act of 1966, and the extent of their authority. Jurisdictional conflicts with other committees and proposals for more coordinated and effective legislative action are discussed. A description is given of the fragmented executive-branch jurisdictional divisions dealing with environmental programs. The article presents proposals for solving conflicts and streamlining the executive environmental programs, policies, and personnel distributions. (Earl-Florida)
W71-04106

IN RE ROMA (ABILITY OF UPLAND OW TO ACQUIRE TITLE TO SUBMERGED LA BY ADVERSE POSSESSION).

227 NYS 46 (Sup Ct App Div 1928).

Descriptors: *New York, *Navigable ri *Ownership of beds, *Prescriptive rights, under water, Land tenure, Real property, Ri Riverbeds, Beds, State governments, Land Legal aspects, Judicial decisions, Land.
Identifiers: *Adverse possession.

On plaintiff's attempt to register title to subme land, the New York Supreme Court held pe riam that an upland owner, as against the s cannot by filling in or by adverse posse acquire title to submerged land under a navigable river. (Hart-Florida)
W71-04146

CHICK SPRINGS WATER CO V ST HIGHWAY DEP'T (STATE'S LIABILITY INVERSE CONDEMNATION WHEN ADEQUATE CULVERT CAUSES FLOODIN

157 SE 842-851 (SC 1931).

Descriptors: *South Carolina, *Condemna *Culverts, *Floods, Eminent domain, State go ments, Administrative agencies, Highways, R Streams, Springs, Recreation, Legisla Damages, Landfills, Adjudication procedure, cial decisions, Legal aspects, Remedies, Go ments.
Identifiers: *Constitutions, Sovereign immunity

Plaintiff landowner sued defendant state hig department for inverse condemnation. Plain land contained a mineral spring and an amuse park. When defendant constructed a road, it t up an embankment on plaintiff's land and pla culvert through it to drain the creek trave plaintiff's tract. The culvert was too small, an creek backed up onto plaintiff's land. Pla brought the action under a constitutional prov requiring compensation for taking of private perty. Defendant contended that plaintiff ha filed his claim within the period required statute consenting to suit against defendant; t fore, sovereign immunity had not been wa However, the Supreme Court of South Car held that the statute was inapplicable proceedings of this type. The constitutional p sion was self-executing and itself waived sove immunity. Holding that plaintiff's injury w 'taking' within the constitutional prohibition court remanded the action for trial. (Hart-Flori
W71-04197

COAL CREEK DRAINAGE AND LEVEE DI SANITARY DIST OF CHICAGO (DRAIN DISTRICT'S LIABILITY FOR DISCHARG EXCESSIVE WATER INTO RIVER).

336 I11 11, 167, NE 807-823 (1929).

Descriptors: *Illinois, *Waste dilution, *Disch (Water), *Drainage districts, Drainage, Sew Hydroelectric plants, Drainage effects, Drai engineering, Drainage practices, Drainage grams, Drainage systems, Electric power pro tion, Electric power, Non-consumptive Navigable rivers, Cities, Sewage, Waste disp Sewage disposal, Judicial decisions, Legal asp Adjudication procedure, Floods.

Plaintiff drainage district sued defendant drai district for injury caused by discharge of ex water into a navigable river. Defendant discharged water to dilute sewage and to gene electrical power. The water ultimately flowed a river which passed through plaintiff district statute, defendant was required to use a prescr volume of water for each 100,000 inhabit

laintiff contended that, in order to generate elec-
icity, defendant had negligently used more water
an required to dilute sewage, causing the river to
verflow and injure plaintiff. The Supreme Court
f Illinois stated that: (1) plaintiff must prove de-
ndant's population, the amount of sewage
ischarged, the amount of water required for dilu-
on, and that excessive water caused the injury; (2)
efendant was required by statute to discharge suf-
cient water to prevent the sewage canal from
eing obnoxious; and (3) defendant might utilize
ater to generate electricity, despite its organiza-
on for drainage purposes, when the proceeds were
ed to support the drainage effort. Determining
at the trial court erred in admitting evidence, giv-
g certain jury instructions, and refusing certain
structions, the court reversed the judgment and
manded the action for a new trial. (Hart-Florida)
71-04198

**TTLE FALLS FIBRE CO V HENRY FORD
ND SON, INC (FLASHBOARDS REDUCING
PARIAN OWNER'S POWER HEAD).**
9 NY 495, 164 NE 558-563 (1928).

escriptors: *New York, *Administrative deci-
ns, *Permits, *Dams, Administrative agencies,
deral governments, United States, Navigable
ers, Navigable waters, Navigation, Legislation,
gal aspects, Judicial decisions, Power head,
droelectric plants, Hydroelectric power,
droelectric project, Licensing, Structures.

aintiff manufacturing company brought action to
join defendant manufacturing company from
aintaining flashboards on a federal dam. Plaintiff
o sought damages resulting therefrom. Defen-
nt had applied for, and received from the Federal
wer Commission, a permit to erect the flash-
ards. The resulting increased water height
creased plaintiff's upstream power head. Plaintiff
erted entitlement to flow unobstructed by in-
iduals, despite subjection to the congressional
wer to regulate navigation. Defendant con-
ded that its permit subjected plaintiff to his right
maintain the flashboards. The Court of Appeals
New York stated that: (1) the flow of a navigable
er is not property subject to the fifth amend-
nt; (2) a riparian owner whose lands are un-
ded has no standing for judicial review of con-
ssional decisions to regulate navigable waters;
in absence of supporting evidence, Federal
wer Commission licensing of projects are
iewable; and (4) the Commission's jurisdiction
ssue licenses is reviewable. Determining that de-
dant's right to obstruct the river must be
blished independently of the license, the court
d defendant liable for plaintiff's injury. (Hart-
rida)
1-04203

**WE V INDIANA HYDROELECTRIC POWER
(AUTHORITY OF HYDROELECTRIC COM-
NY TO CONDEMN LAND FOR FLOWAGE).**
NE 220-226 (Ind 1926).

criptors: *Indiana, *Hydroelectric plants,
ndemnation, *Dams, Eminent domain,
kwater, Legislation, State governments, Ripari-
land, Riparian rights, Hydroelectric power,
-navigable waters, Judicial decisions, Legal
ects, Electric power industry, Electric power-
ts.

ntiff hydroelectric company sought to condemn
rian land owned by defendant. Plaintiff had to
chase the land, which the backwater from its
would overflow, but was unsuccessful. Defen-
contended that plaintiff could not condemn
lands. The Supreme Court of Indiana held that:
A riparian owner may utilize water lawfully, if
water flows thereafter in its normal state; (2) A
lation grant is not required to erect a dam not
ring the stream's natural course; (3) Plaintiff
authorized by statute to condemn lands for an
orized purpose; (4) A declaration of public
ssity was unnecessary; (5) Plaintiff's lease of electric power did not affect its ability to condemn lands; (6) Operation of the dam for electricity was a public use; and (7) Evidence of comparative benefits and damages from the dam was properly excluded by the trial court. Plaintiff had properly condemned defendant's land after reasonable efforts to purchase. (Hart-Florida)
W71-04217

PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
301 Pa 475, 152 A 682-685 (1930).

Descriptors: *Pennsylvania, *Condemnation, *Land tenure, *Ownership of beds, Flooding, Compensation, Dams, Real property, Eminent domain, Railroads, State governments, Legal aspects, Judicial decisions, Governments, Land, Backwater.
Identifiers: *Adverse possession.

Plaintiff possessor of riparian land sued to eject defendant railroad. The disputed land had been previously overflowed by backwater from a dam, and title to the flooded land was vested in the state by condemnation. The dam later broke, and the water receded. The dam was not restored. Plaintiff took possession, but the state conveyed the land to defendant. Plaintiff claimed title by abandonment, in that defendant had failed to use the land, and by adverse possession. Noting that whether compensation was paid for the condemned land was immaterial, the Supreme Court of Pennsylvania held that title had been in the state by condemnation. Plaintiff could eject defendant only on the strength of his own title, rather than the weakness of defendant's. The court held that the state's title was not divested by abandonment. Failure of a state's grantee to use granted land may result in divestment of the grantee's title, but does not revest title in its former owner. Determining that plaintiff had not established adverse possession for the statutory period, the court held that title was in defendant. (Hart-Florida)
W71-04243

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (RIGHT TO FILL TO BULKHEAD LINE INCLUDES RIGHT TO MAINTAIN FLOATING DRY DOCK).

146 Misc 404, 262 NYS 212-216 (1932).

Descriptors: *New York, *Landfills, *Bulkhead line, *Piers, Navigable waters, Beds, Navigation, Docks, Remedies, Riparian land, Riparian rights, Riparian waters, Ownership of beds, Real property, Land tenure, Relative rights, Regulation, Governments, State governments, Legal aspects, Judicial decisions.

Plaintiff dock company brought action to restrain defendant dock company from mooring a floating drydock adjacent to defendant's pier and over defendant's submerged land. Plaintiff contended that the dry dock interfered with navigation and with access to plaintiff's pier. Defendant contended that the dry dock was inside the established bulkhead line and could be maintained under defendant's right to fill up to the bulkhead line. The court noted that the grant of lands under water and the establishment of a bulkhead line gave defendant a right to fill. Although there is a right of navigation over such submerged land until the right to fill is exercised, defendant had the right to maintain the dry dock as long as the required minimum clearance between piers was maintained. Plaintiff could not, at the expense of defendant's property rights, enlarge his right of access beyond the minimum clearance. (Liptak-Florida)
W71-04245

HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
319 111 142, 149 NE 752-754 (1925).

Descriptors: *Illinois, *Ditches, *Drainage districts, *Natural flow, Drains, Drainage systems, Natural flow doctrine, Drainage water, Drainage, Surface waters, Surface runoff, Levees, Drainage effects, Legislation, Water rights, Alteration of flow, Obstruction to flow, Watersheds (Divides), Watershed management, Legal aspects, Judicial decisions.

Plaintiff drainage and levee district petitioned for permission to construct a drainage ditch and connect it with defendant district's ditch. Landowners in plaintiff district had petitioned for and obtained an order requiring plaintiff to improve its drainage. Defendant objected and contended that the connection would require the removal of a natural barrier to the flow of water. This would change the natural flow of water from east to west. Reversing a judgment for plaintiff, the Supreme Court of Illinois held that, where the connection would result in reversing the direction of the natural flow of water and the removal of natural barriers to flow, plaintiff had no right or authority to connect its ditches to that of defendant. (Liptak-Florida)
W71-04246

PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
167 NE 721-730 (Ind App 1929).

Descriptors: *Indiana, *Cities, *Railroads, *Water supply, Water pollution sources, Water pollution, Water pollution effects, Public health, Mortality, Pollutants, Epidemics, Diseases, Pipelines, Water delivery, Adjudication procedure, Judicial decisions, Legal aspects, Damages, Remedies.
Identifiers: *Contaminated water supply.

Plaintiff administrator of decedent's estate sued defendant railway company and defendant municipality for wrongful death. The city had authorized the railroad to tap into its water system. The railroad's system was defective and permitted contaminated water to flow into the municipal system, causing decedent's demise from typhoid. Plaintiff asserted that the city was negligent in failing to inspect the railroad's connection and that the railroad had negligently maintained its system. The Appellate Court of Indiana stated that the city was not a guarantor of its water, but was bound to use reasonable care to insure an uncontaminated supply. Plaintiff was not required to prove with absolute certainty that drinking water caused decedent's death, nor was plaintiff required to prove that the city actually knew the water was contaminated. Determining that the evidence supported the trial court's holding that defendants' negligence was the proximate cause of decedent's death, the court held both liable. (Hart-Florida)
W71-04252

PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
Committee on Public Works (U. S. Senate). Subcommittee on Flood Control - Rivers and Harbors.

Hearings Before the Subcommittee on Flood Control - Rivers and Harbors, of the Public Works Committee, United States Senate, 90th Congress 2nd Session, Jan 30, 31 and Feb 1 and 7, 1968. 96 p, 10 illus.

Descriptors: *Political aspects, Federal government, Federal Project Policy, *Permits, *Water permits, Administrative agencies, Public rights, Recreational facilities, Reservoir operation, *Legislation.
Identifiers: Floating facilities, Federal reservoirs.

The subcommittee met to consider S2236, a bill which would prohibit the Secretary of the Army from collecting any fee for the issuance of any permit or license for any private floating facility on any of the waters of any project administered by the Secretary acting through the Chief of Engineers. The bill would not prohibit the Secretary from requiring a permit or license for any such floating facility. The Corps of Engineers issues permits allowing members of the public to construct floating facilities for private use on Federal Reservoir Projects. The Corps also allows commercial floating facilities to be constructed on these reservoirs in return for a rental fee. On November 17, 1966 the Corps issued a circular stating that permits would henceforth be issued upon a charge to all owners of floating facilities used for private purposes. Voluminous testimony presented to the subcommittee reflected the general feeling that the change would be contra to the nation's long established toll-free waterways policy and would tend to defeat the purposes of federal legislation to expand outdoor recreational facilities, notwithstanding that the fee purports to charge for the use of federal land beneath the facility and not for the use of the water itself. No decision is reported. (Molica-Florida)
W71-04254

HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS; THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90th CONGRESS, 2nd SESSION.
Committee on Public Works (U. S. Senate). Subcommittee on Flood Control - Rivers and Harbors.

Hearings - Sub Comm on Flood Control - Rivers and Harbors - Comm on Pub Wks, US Senate, Jan 30, 31, Feb 1 and 7, 1968. 194 p.

Descriptors: *Federal government, *Legislation, *Federal project policy, *Projects, Project purposes, Project benefits, Costs, Cost allocation, Cost-benefit ratio, Local governments, Economics, Navigable waters, Administration, Adoption of practices, Flood control, Flood protection, Aquatic weed control, Beach erosion, Harbors, Construction, Multiple purpose projects, Breakwaters, Legal aspects, Social aspects, Regions.

During these hearings before the Subcommittee on Flood Control - Rivers and Harbors, several bills were discussed, witnesses heard and documents presented. Items considered were a proposed dock charge by the Corps of Engineers, and flood control projects for: Carlsbad, N. M.; Aquilla Creek and Texas City, Texas; Little Dell Reservoir, Utah; and the Norwalk River Basin in Connecticut. Also considered were harbor construction and improvement projects for: Fall River, Mass.; Bristol, Rhode Island; and Forestville Harbor and Tawas Bay, Michigan. The Fort Pierce, Florida, Beach Erosion Control Project and the Water Hyacinth Control Program in Florida were discussed. On each project, evidence was taken as to project purposes, effects and benefits of the project, costs, cost-benefit ratio, and local responsibilities for paying the non-federal share of the project. The U. S. Army Corps of Engineers was responsible for all projects. (Caldwell-Florida)
W71-04255

PROCEEDINGS: CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.
For primary bibliographic entry see Field 05G.
W71-04256

LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
For primary bibliographic entry see Field 04A.
W71-04257

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST UNITED STATES RIVER BASINS.
United States Study Commission, Southeast River Basins, Plan for Development of the Land and Water Resources of the Southeast River Basins (1963). 135 p.

Descriptors: *River basin development, *Southeast U. S., *Resource development, *Planning, Project planning, Terrain analysis, River basins, Regions, Benefits, Costs, Cost sharing, Future planning (Projected), Flood control, Recreation, Navigation, Soil conservation, Hydroelectric power, Reservoirs, Water supply, Multiple-purpose projects, Economics, Industrial production, Land use, Water utilization.

The United States Study Commission has developed a comprehensive plan for the development of the resources of the river basins of the Southeastern United States. The report is a detailed explanation of the plan. Part One includes a description of the Southeast River Basins Area, a discussion of its resources, and a presentation of the present and future population and economy. Part Two presents the needs of the Area for each aspect of the plan. Part Three describes planning procedures as applied to the study. Part Four presents the comprehensive plan broken down by individual river basins. Part Five contains the Commission's conclusions and recommendations. The plan was designed to meet the needs of the Area through the year 2000. Aspects of the plan for each basin include flood control, water supply, navigation, hydroelectric power, drainage and irrigation, soil conservation, forest conservation, pollution abatement, recreation, and other beneficial purposes. (Caldwell-Florida)
W71-04266

COMPETITION FOR WATER IN AN EXPANDING ECONOMY: POLICIES AND INSTITUTIONS,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
Maurice M. Kelso.
Nov 1, 1967. 20 p, 2 ref. OWRR Project B-003-ARIZ (5).

Descriptors: *Water rights, *Riparian rights, *Appropriation, Surface waters, Groundwater.

The need for major changes in the institutional and legal allocation of water are discussed. Riparian rights and appropriative rights, as they have evolved through custom and judicial decisions, have become inflexible institutions. The present system of water tenure does not provide for the most socially beneficial development and delivery of growing water needs. It is suggested that the bargaining transaction and the market are the best adapted devices for readjusting water institutions. (Holmes-Rutgers)
W71-04268

HUNTER V VAN KEUREN (BOUNDARY DISPUTE AT LAKESHORE).
130 Misc 599, 224 NYS 153-161 (Sup Ct 1927).

Descriptors: *New York, *Land tenure, *Boundary disputes, *Shores, Boundaries (Property), Lake shores, Littoral, High water mark, Low water mark, Real property, Navigable waters, Non-navigable waters, Legal aspects, Judicial decisions, Land, Lakes.

In an action of ejectment, the Supreme Court of New York stated that: (1) in a conveyance of lands bounded by navigable waters, title extends to the high water mark; and (2) 'shore' or 'shore line' in a title description means the land between the high and low water marks. (Hart-Florida)
W71-04276

DUCK ISLAND HUNTING AND FISHING CL V EDWARD GILLEN DOCK, DREDGE A CONSTRUCTION CO (DISSOLUTION DRAINAGE DISTRICT).
330 Ill 121, 161 NE 300-305 (1928).

Descriptors: *Illinois, *Drainage programs, *C tracts, *Navigable waters, Legislation, Administ tive agencies, Administrative decisions, St governments, Federal government, Permits, De Cost repayment, Drainage, Rivers, Strea Navigable rivers, Judicial decisions, Legal aspect

Plaintiff club petitioned to have a drainage distr dissolved. Defendant dredging company, havin contract with the district, contested the action. T first drainage plan was ordered by the county cou assessments were levied, and the contract with fendant was let, all without approval by the st public works department and the War Departme These plans were modified, and an additional sessment was levied, whereupon district l downers petitioned for dissolution. The petiti was approved under a statute permitting disso tion when no indebtedness existed and the costs dissolution had been advanced. Defendant c tended that the existence of its contract evidenc an outstanding indebtedness prohibiting disso tion. Plaintiff asserted that since the contract v let prior to approval by the public works and W departments, it was illegal and void under statu prohibiting obstruction of navigable waters witho approval. Sustaining plaintiff's assertion by not that navigable waters were involved, the Supre Court of Illinois held the dissolution valid, n withstanding a subcontractor's expenditures reliance on the contract. (Hart-Florida)
W71-04277

CITY OF SALEM V HARDING (CIT NEGLIGENCE IN CAUSING ILLNESS BY CO TAMINATION OF WATER SUPPLY).
121 Ohio St 412, 169 NE 457-460 (1929).

Descriptors: *Ohio, *Water supply, *Public heal *Water pollution, Water pollution sources, Wa pollution effects, Diseases, Epidemiology, Pol tants, Epidemics, Pipelines, Sanitary engineeri Sewage effluents, Sewage bacteria, Sewa disposal, Sewage, Cities, Municipal wastes, Sewe Streams, Legal aspects, Judicial decisions, Adju cation procedure.

Plaintiff citizen sued defendant city for daughter's illness, which he alleged was caused contamination of the water supply. The line supp ing water for plaintiff was laid next to a priv sewer line which was contaminating a strea When efforts to persuade residents to disconn from this private sewer failed, defendant's hea officer plugged the sewer. This caused the sewa to back up into plaintiff's water supply, and pla tiff's daughter became ill. Defendant contend that it was not responsible for the acts of its hea officer acting under the instructions of the board health. Noting that the sewer was a nuisance, Supreme Court of Ohio held that defendant was ble for the acts of its officers, who must use ordi ry care to prevent contamination of the wa supply. However, the court observed that a m nicipality is not a guarantor of the purity of water supply, but is only held to the exercise of dinary care. Judgment for plaintiff was affirm (Hart-Florida)
W71-04278

MANNING V METROPOLITAN DISTRI COMM'N (CONSTITUTIONALITY OF A AUTHORIZING CONDEMNATION F DRAINAGE).
270 Mass 348, 169 NE 910-911 (1930).

Descriptors: *Massachusetts, *Easemen *Legislation, *Condemnation, Drainage, Emin domain, Farms, Ditches, State governments, Na ral flow doctrine, Judicial decisions, Legal aspec Surface drainage, Governments, Administrati agencies.

Identifiers: *Constitutionality.

Plaintiff farm owner petitioned for a writ of certiorari to quash eminent domain proceedings brought by defendant commission to establish a drainage easement across plaintiff's land. Water drained from a cemetery adjacent to plaintiff's land, and plaintiff had obtained an injunction restraining the cemetery company from diverting water onto plaintiff's land. The easement sought by defendant restored this drainage across plaintiff's land. Plaintiff asserted: (1) that the cemetery instituted and secured the drainage legislation to avoid the court decree, (2) that the act was a mere contrivance for the cemetery's benefit, and (3) that therefore the act was unconstitutional as a taking for private use. Plaintiff furthermore contended that the legislation was unconstitutional since existing natural drainage would be adequate with improvements. Stating that the statute was presumed valid, and that plaintiff had not shown that the cemetery had obtained it for its own benefit, the Supreme Judicial Court of Massachusetts rejected plaintiff's first assertion. Furthermore, the court held that the validity of the act authorizing the condemnation was unaffected by the existence of a natural drainage system. (Hart-Florida)
W71-04279

TRUCTURE OF PUBLICLY-OWNED WATER TILITIES,
lorida Univ., Gainesville. Dept. of Economics.
. W. Fristoe, F. O. Goddard, and N. G. Deig.
ournal of American Water Work Association, Vol 2, No 4, April 1970, p 215-219. 2 tab, 3 ref.

escriptors: *Public utilities, Local governments, tate jurisdiction, Water rates, Indiana, Maine, lontana, West Virginia, Wisconsin, *Utilities.
lentifiers: *City councils.

study was made of control over publicly-owned ater systems in the United States, dealing particurly with the relationships that exist between the ater utilities and municipal governments. The sults of questionnaires sent to the chief water ility executives of water systems in 340 cities with opulations of 10,000 or more revealed the difculties that municipal water systems face when atmpting to operate as business enterprises. Comarisons were made of the ways prices are deterined, quality controlled and quantity determined nder various means of control of publicly-owned ater systems. (Holmes-Rutgers)
71-04281

HE INSTITUTIONAL FRAMEWORK FOR ATER MANAGEMENT IN ENGLAND AND ALES,
uce Mitchell.
atural Resources Journal, Vol 10, No 3, July 70, p 566-589. 20 ref, 2 fig.

escriptors: *Water resources development, anning, Multiple-purpose projects, Water law, nstitutions.
entifiers: *England, Wales, White Paper, Water sources Board.

e author describes the considerable progress at has been made since 1940 in improving water nagement practices at the micro-level in End and Wales, but concludes that greater attenn must be given to the macro-level of planning to k together proposals for different variables, loities and regions. The article details the progress at has been made in the introduction, application d acceptance of river basin planning, multiplerpose resource use and the regrouping and reorhization of water undertakings. (Holmes-Rutrs)
71-04282

ATER AND CULTURE: NEW DECISION LES FOR OLD INSTITUTIONS,
zona Univ., Tucson. Bureau of Ethnic Research.
rland Padfield, and Courtland L. Smith.
Rocky Mountain Social Science Journal, Vol 5, No 1, p 23-32, April 1968.

Descriptors: *Arid lands, *Water allocation (Policy), *Water districts, *Institutions, *Water utilization, Water conservation, Water distribution (Applied), Water law, Water resources, Water transfer, Water users, Water works, Arizona, Semiarid climates, History, Social aspects, Developed waters, Irrigation practices, Irrigation effects, Agriculture, Crop production, Labor supply, Economics of scale, Economic feasibility, Dry farming, Hydroelectric power, Droughts, Legal aspects, Water contracts, Great Plains, Groundwater.
Identifiers: *Salt River Project (Arizona), *Waterspace, *Agricultural mechanization.

As American agriculture moved westward from the humid east to the prairies to the semiarid Great Plains, changes in water availability resulted in changes in agricultural operations. The small, family-size subsistence unit developed into the large-scale, mechanized dry farms of the plains. When the plains formula was moved to the arid West, irrigation created a bastardized agriculture in which large-scale crop operations developed through mechanization of planting and growing phases, but which depended upon large, depressed migratory labor populations for harvesting. In arid lands, areas of high water availability impose sharp spatial limitations on agriculture and settlements, and such oases are termed 'waterspace'. This waterspace led to a new agrarian institution--the water users' association. The history is traced of 1 such association in the Salt River Valley, Arizona. Originally this and other associations were committed to the problems of water distribution for agricultural purposes, but recent urban and industrial competition for waterspace have shifted their foci to urban water needs and hydroelectric power. In Arizona this competition, together with declining groundwater levels, seem to indicate a contracting agricultural sector. (Casey-Arizona)
W71-04296

OFFSHORE OIL SPILLS: AN EVALUATION OF RECENT UNITED STATES RESPONSES,
Ved P. Nanda, and Kenneth R. Stiles.
San Diego Law Review, Vol 7, No 3, p 519-540, July 1970. 22 p, 162 ref.

Descriptors: *Legislation, *Water pollution, *Oil, *Oil industry, United States, Exploitation, Oil fields, Oil reservoirs, Natural gas, International waters, Exploration, Geologic formations, Water pollution effects, Water pollution sources, Pollutants, Oil wells, Drill holes, State governments, Federal Government, California, Submerged Lands Act, Legal aspects, Water pollution control, Pollution abatement, Non-structural alternatives.
Identifiers: *Oil spills.

Three recent oil spills--the Torrey Canyon disaster, the Santa Barbara channel faulted strata leakage, and the Gulf of Mexico blowouts--have initiated action by the United States to prevent similar future occurrences. Evaluation of these responses is the objective of this article. Policy considerations conflicting with the prevention of oil spills, such as increasing oil and gas consumption in the United States, are discussed. It is observed that exploitation of offshore petroleum reserves is a relatively recent venture. The development of governmental regulations concerning offshore drilling through the Submerged Lands Act and the Outer Continental Shelf Lands Act is examined. The causes, results, and responses to the Santa Barbara spill are analyzed in detail. The authors emphasize that compliance with the California regulations for offshore wells would have prevented the Santa Barbara spill. The Gulf of Mexico blowouts are examined similarly. The authors conclude that legislation pertaining to oil spills should provide: (1) strict liability for clean-up and damages from spills, (2) broad discretion in the regulating agency to prescribe rules for offshore petroleum exploitation, and (3) for compulsory adjudication to determine fault in pollution incidents. (Hart-Florida)
W71-04305

RECLAMATION IN THE UNITED STATES,
California State. Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 06C.
W71-04306

FEDERAL WATER-POWER LEGISLATION,
Columbia Univ., New York. Studies in the Social Sciences.
Jerome G. Kerwin.
Federal Water-Power Legislation, New York, AMS Press, Inc., 1968. 396 p, 10 tab, 362 ref, 8 append.

Descriptors: *Federal Power Act, *Water allocation (Policy), *Federal government, *Legislation, Water resources development, Federal-state water rights conflicts, Federal jurisdiction, State jurisdiction, Legal aspects, Judicial decisions, Public utilities, Economic impact, Political aspects, Political constraints, Water utilization, Hydro-electric plants, Riparian rights, Administration, Navigable rivers, Water resources, Prior appropriation, Power marketing, Economic efficiency, Electric power industry.
Identifiers: *Constitutionality.

Detailed in this study are the legal, economic, and historical aspects of the battle for federal water-power legislation, culminating in the Federal Water Power Act of 1920. The comparative economic advantages of water power, its historic uses, and its potential for future development are discussed in Chapter I. The legal and constitutional aspects of federal water power are presented in Chapter II. Rights in running water under both riparian rights and prior appropriation doctrines are discussed. Constitutional issues examined by the author include: (1) the extent of state water power, (2) the federal government's right to lease water rights in the public domain, (3) the treaty-making power as a source of federal water power, (4) federal power over navigable streams, and (5) the extent of federal administrative power and discretion. In Chapters III and IV congressional battles over water-power legislation before 1920 are examined. The enactment of the Federal Water-Power Act of 1920, with full text provided in an appendix, is discussed in Chapter V. Progress under the Act, its weaknesses, legal challenges to the Act, and the extent of activity undertaken pursuant to the Act are considered in Chapter VII. (Earl-Florida)
W71-04307

PUBLIC WATER POLICY IN TENNESSEE.
Public Administration Service, Chicago, Ill.

June 1956. 175 p, 19 fig, 22 tab, 72 ref, 1 append.

Descriptors: *Tennessee, *Water policy, *Water law, *Water utilization, Administration, Riparian rights, Reasonable use, Water supply, Surface waters, Groundwater, Public rights, Water resources development, Water pollution, Domestic water, Municipal water, Industrial water, Competing uses, Prior appropriation, Water conservation, Irrigation, Judicial decisions, Legal aspects, Water quality, Administrative agencies, Legislation.

Fulfilling the objectives of a bill passed by the Tennessee legislature, the State Water Policy Commission had this study prepared on Tennessee's water resources and water laws. Chapter I is an introduction and summary and outlines existing water laws in Tennessee, available water supplies, various water uses, and a proposed state water policy. Chapter II discusses Tennessee water law under two headings: (1) the common law riparian doctrine relating to individual rights and obligations with respect to water utilization; and (2) statutory law in such areas as water pollution, public health, flood control and drainage, navigation, water supply, recreation, and interstate relations. Chapters III through V gives factual information on the availability of water resources, various types of withdrawal uses of water, and uses requiring modification and control of stream flow. Some policy recommendations are made in these chapters. Chapter VI is devoted entirely to water policy. It

recommends: (1) statutory modification of the common law, including declaration of public ownership of the water supply, elimination of conflicts in the law, and a move to some type of appropriation system; (2) establishment of a state division of water resources to administer water resources; and (3) creation of agencies for local water users. (Duss-Florida)
W71-04308

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 09D.
W71-04309

TOWN OF PERU V STATE (COMPENSATION FOR STATE'S APPROPRIATION OF TOWN'S DOCK).

315 NYS2d 775-777 (Sup Ct App Div 1970).

Descriptors: *New York, *Eminent domain, *Compensation, *Docks, Piers, Lakes, Navigable waters, Navigation, Boats, Cities, Access routes, Condemnation, Land, Legal aspects, Judicial decisions, Roads, Recreation, Local governments.

Plaintiff town sought compensation for appropriation by defendant state of a dock on Lake Champlain and of land providing an access route to the dock. The town had maintained the dock from the time of purchase, constructed a boat launching ramp, and held the dock for the use of town residents. Plaintiff contended it held the dock in a proprietary capacity, while defendant contended that plaintiff held the dock in a governmental capacity, for the furtherance of navigation, and therefore was not entitled to compensation for its appropiation by defendant. The Supreme Court of New York reversed a lower court's action by defendant. The Supreme Court of New York reversed a lower court's dismissal of plaintiff's claim. The town maintained the dock for use of residents only and therefore held the property in a proprietary capacity. The dock was used by pleasure craft and not cargo vessels. Private piers erected on navigable waters cannot be appropriated for a purpose not in the interests of navigation without payment of compensation. (Duss-Florida)
W71-04310

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
315 NYS2d 9-12 (Sup Ct 1970).

Descriptors: *New York, *Water pollution, *Public rights, *Water pollution control, Legislation, Bays, Water pollution sources, Airports, Prescriptive rights, Remedies, Environment, Legal aspects, Judicial decisions, Navigable waters, Public health.

Plaintiff state of New York sought to temporarily enjoin defendant Port of New York Authority from polluting a bay through the discharge of fuel or oil from John F. Kennedy International Airport, which was operated by the defendant. Defendant contended that: (1) it should not be singled out for prosecution as it was one of many contributors to the pollution, (2) the pollution had continued for many years, and (3) issuance of an injunction would require closing of the airport. The Supreme Court of New York County held the motion in abeyance pending a further hearing. The people of statute have an interest in pollution of the state's property. Defendant had no defense because of the duration of the pollution, since there is no prescriptive right to continue wrongdoing. However, since an absolute injunction would close down the airport, the motion would be held in abeyance pending a further hearing on the practicalities of the situation. (Duss-Florida)
W71-04311

LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
459 SWd 150-152 (Ky 1970).

Descriptors: *Kentucky, *Floods, *Alteration of flow, *Culverts, Flood damage, Rain, Rain water, Storm runoff, Streamflow, Reasonable use, Streams, Obstruction to flow, Relative rights, Landfills, Diversion structures, Diversion, Land development, Real property, Land use, Land tenure, Legal aspects, Judicial decisions.
Identifiers: *Injunction (Prohibitory).

Plaintiff city gas and electric utility sought damages from defendant property owners for injuries sustained when defendants' pipeline backed up a stream. In preparing land for construction, defendants has installed a culvert to re-route a stream under their property. Waste matter washed into and stopped up the culvert during unusually heavy rainstorms. Plaintiffs averred defendants creation of this artificial condition had caused the flooding of their property. Defendants contented the rainfalls were an act of God for which they were not liable. The court held that a property owneris liable for flood damages resulting from improper culvert construction where proper construction would have guarded against even unusually heavy rainfalls. The court rejected the defendants act-of-God defense, stating that such an act must be unforeseeable, unpredictable, and of a character which cannot be guarded against. Ruling that the defendants had not made reasonable use of the land, the court affirmed the award of damages to plaintiff. However, a prohibitory injunction against defendant was denied since there had been no showing that flooding would reoccur. (Earl-Florida)
W71-04312

ELKHORN CITY LAND CO V ELKHORN CITY (ABANDONMENT OF WATER WORKS PROPERTY).

459 SW2d 762-765 (Ct App Ky 1970).

Descriptors: *Kentucky, *Land tenure, *Land use, *Water works, Real property, Contracts, Reservoirs, Local governments, Land classification, Landfills, Utilities, Public utilities, Legal aspects, Judicial decisions.

Plaintiff grantor sought reversion of defendant city's interest in property conveyed for water works purposes only. The deed provided for reversion to grantor upon abandonment of the premises for water works use. Plaintiff asserted that defendant's closing of a reservoir and sale of landfill constituted abandonment. Defendant denied abandonment. The Court of Appeals of Kentucky held that the sale of landfill and the closing of a reservoir do not establish abandonment for water works purposes so long as other water work operations continue. Relying on defendant's continued operation of a pumping station, filter plant, and water intake on the property, the court ruled that defendant's actions did not constitute abandonment. The court noted that defendant's sale of landfill did not interfere with the water work's operations in any way. Judgment for defendant was affirmed. (Earl-Florida)
W71-04313

SCANLAN V HOPKINS (LEGAL CONSEQUENCES OF AGREEMENT BY GRANTOR TO CONSTRUCT CULVERT OVER NATURAL WATERCOURSE).
270 A2d 352-357 (Vt 1970).

Descriptors: *Vermont, *Easements, *Land tenure, *Surface runoff, Third party effects, Relative rights, Riddance (Legal aspects), Repulsion (Legal aspects), Drainage, Ponds, Surface waters, Real property, Culverts, Drainage water, Natural flow doctrine, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff grantee sought damages from defenda
grantor for breach of warranty against encu
brances. Defendant, prior to the conveyance
plaintiff, conveyed property to a third party wit
deed agreement that defendant would construc
culvert to conduct surface water to a pond. Defe
dant subsequently conveyed the land containi
the pond to plaintiff. The culvert enclosed but
not alter in any manner a previously existing na
ral watercourse. Plaintiff contended the de
agreement created a servitude against his proper
The Supreme Court of Vermont held an obligati
in a deed to a third party to construct a culv
which merely covers over a natural watercou
does not create an easement as to subsequent gra
tees. The court stated that: (1) doubts regardi
easements are resolved against the existence
such easements; and (2) a showing of intention
add benefits to or increase the burden on land,
of the essentiality of an easement to the enjoyme
of land is required to establish the existence of
easement. Finding no easement, the court rul
there had been no breach of defendant's covena
However, the court found plaintiff, as an owner
lower land, obligated to accept the natu
discharge of surface water from the culvert into
pond. Judgment for defendant was affirmed. (Ea
Florida)
W71-04314

HANSON V BERT WAY ESTATE (RIPARIA RIGHTS OF ADVERSE POSSESSOR).
181 NW2d 537-541 (Ct App Mich 1970).

Descriptors: *Michigan, *Riparian righ
*Prescriptive rights, *Islands, Riparian land, La
tenure, Real property, Riparian waters, Relati
rights, Rivers, Legal aspects, Judicial decisio
Boundaries (Property), Priorities, Real property.

Plaintiff owner of riverfront property, in p
through deed and in part through adverse poss
sion brought action to quiet title to several parc
of land and an island. Plaintiff contended that t
riparian rights doctrine vested him with ownersh
of the island, which was located on his side of t
river's thread. The Court of Appeals of Michig
held that in determining the title to an island
distinction is made between a riparian own
acquiring title by deed and one who acquires ti
through adverse possession. Finding title to t
island in the defendant, the court stated that p
session sufficient to accord riparian rights, requi
merely: (1) occupancy with the intent to contr
(2) a ceasing of occupancy, without abandonme
where no other person obtains possession; or (
the right to immediate occupancy of land, if
other person is in possession. (Earl-Florida)
W71-04315

CITY OF LEXINGTON V LEXINGTON WATE CO (WATER COMPANY'S PROFIT IN LAN SALE NOT RELEVANT IN FIXING RATES).
458 SW2d 778-780 (Ct App Ky 1970).

Descriptors: *Kentucky, *Water rates, *Wat
works, *Water users, Water costs, Utilities, Lan
Administrative agencies, Administrative decisio
Watercourses (Legal), Cities, Condemnatio
Public rights, Legal aspects, Judicial decisions, A
judication procedure.

Plaintiff water company petitioned the Kentuc
Public Service Commission for an increase in rat
The city of Lexington protested on the ground th
for rate purposes consumers were entitled
benefit from the water company's profit on a sale
land. The city contended that plaintiff had acquir
the land by condemnation or threat thereof. T
Commission ruled for the city and plaintiff a
pealed. Affirming a reversal of the Commissio
ruling by the lower court, the Court of Appeals
Kentucky held that the sale of land could not
considered by the Commission on petition by t
company for an increase in rates. Profit made
the sale of non-depreciable land no longer used
serving the public is not relevant to the fixing

ites. Customers would not have had to share in ny loss on the sale of the land. Neither should they are in any profit. (Duss-Florida)
71-04316

ILSON V ST REGIS PULP AND PAPER CORP OUNDARY LINE BETWEEN PROPERTIES OCATED ON OPPOSITE SIDES OF STREAM).
0 So 2d 137-144 (Miss 1970).

escriptors: *Mississippi, *Boundary disputes, and tenure, *Thalweg, Channels, Riparian land, parian rights, Streams, Sand bars, Sands, avels, Damages, Fresh water, Judicial decisions, gal aspects, Ownership of beds, Beds.

aintiff riparian landowner sought to confirm title a sandbar in a stream as against defendant ripari- landowner. Plaintiff's land was located on one e of the stream while defendant's was on the ner. Defendant denied that plaintiff owned the d and filed a cross bill for damages for removal sand and gravel from the sandbar by plaintiff. th parties agreed that the thread of the stream s the dividing line between their properties. wever, plaintiff contended the thread was the lweg of the channel, while defendant contended was the line midway between the opposite relines when the water is at its ordinary stage. e Supreme Court of Mississippi affirmed a lower rt decision for plaintiff. The boundary between perties located along freshwater streams lying olly within the state is the thalweg or deepest tion of the channel of the stream. The boundary hus subject to change due to the gradual vagran- s of the stream. The court denied a petition for earing. One judge dissented on the ground that thalweg rule is not applicable to land bounded freshwater streams within the state. He felt that boundary should have been a line midway ween the shores. (Duss-Florida)
1-04317

COBS V ELWELL (RIGHT TO PREVENT NSTRUCTION ON BEACH).
A 61-62 (NJ 1930).

scriptors: *New Jersey, *Riparian rights, parian land, *Beaches, Navigable waters, islation, Compensation, Land tenure, High er mark, Low water mark, Cities, Legal aspects, icial decisions, Construction, Local govern- nts, State governments, Public rights.

State of New Jersey, on the relation of plaintiff ch property owner, sought a writ of mandamus pelling defendant city building inspector to e a permit to plaintiff to erect a building on the ch strand. In the original grant of plaintiff's land the state riparian commissioners, the right was rved for the city council to define the bounda- of the beach strand and remove and prevent encroachments on it. This right was given pur- nt to statutory authority. Acting upon this grant city council enacted an ordinance establishing boundaries of the beach and providing for oval and prevention of encroachments. Plain- s proposed building was such an encroachment. Supreme Court of New Jersey found the ute constitutional and the ordinance valid and ied the petition. (Duss-Florida)
1-04318

YCO REALTY CO V MAYOR, COUN- OR, AND ALDERMAN OF ANNAPOLIS GHT OF CITY TO DISCHARGE SEWAGE O STREAM).
A 273-278 (Md App 1930).

criptors: *Maryland, *Water pollution, wage disposal, *Cities, Navigable waters, age, Sewers, Municipalities, Public health, lic rights, Streams, Riparian land, Riparian ts, Potable water, Sewage bacteria, Beds, ership of beds, Legal aspects, Judicial deci- s, Damages, Remedies, Tidal waters, Shores, age effluents, Discharge (Water).

Plaintiff realty company sought to enjoin defendant city of Annapolis from discharging sewage into a creek along which plaintiff owned land. Plaintiff alleged defendant's acts rendered the creek's water unfit for drinking, bathing, and other recreation. Defendant alleged that it had authority to discharge sewage into the creek for the public's benefit. Defendant also denied that its acts caused the pollution, alleging it was due to natural causes. The Court of Appeals of Maryland affirmed a judgment for defendant. Evidence showed that defendant's acts did pollute the creek. However, the condition existed long before plaintiff bought its land, and was doubtless reflected in the price he paid for it. Discharge of sewage by municipalities into tidal waters by authority of the state is not a nuisance. Under such circumstances incidental damage to private owners gives rise to no remedy. The state is the owner of the beds of navigable waters and may grat to municipalities the right to discharge sewage therein. Such a grant would not absolve a municipality of liability where its actions were negligent or indicative of wanton disregard of public or private rights. However, there was no evidence of wantoness or negligence in the instant case. (Duss-Florida)
W71-04319

STATE V PLANT (VIOLATION OF STATUTE PROHIBITING OPERATION OF BOAT FOR HUNTING DURING CERTAIN HOURS).
155 A 35-36 (Me 1931).

Descriptors: *Maine, *Navigation, *Navigable rivers, *Hunting, Game birds, Water utilization, Rivers, Legislation, State governments, Judicial decisions, Legal aspects, Recreation, Navigable waters, Highways, Regulation.

Plaintiff state brought criminal prosecution against defendant duck hunter for violation of game law. The statute prohibited operation of a boat for hunting earlier than one and one-half hours before sunrise. Defendants launched their boat a few minutes before said period, and proceeded downriver to hunt ducks on a distant island. Defendant contended that the operation of the boat at that time was for navigation rather than hunting, and therefore the statute was not violated. The Supreme Judicial Court of Maine noted that the navigable river was open at all hours for lawful business and pleasure, notwithstanding the state authority to control navigable waters for propogation of fish and protection of migratory birds. The court held that plaintiff was without authority to suspend the general use of a navigable river as a public highway. Since defendant had no intention of hunting ducks until he reached the island, he had not violated the statute. (Hart-Florida)
W71-04320

WEST SHORE RR V STATE (LIABILITY FOR APPROPRIATION OF RIVER FLOW FOR NEW CHANNEL OUTSIDE RIVER).
215 NYS 684-689 (1926).

Descriptors: *New York, *Canal construction, *Condemnation, *Alteration of flow, Railroads, Bridges, Piers, Eminent domain, Channel improvement, Canals, Natural flow doctrine, Riparian rights, Riparian waters, Public rights, Compensation, Damages, Diversion, Water level, Streamflow, Navigable waters, Navigable rivers, Navigation, Legal aspects, Water law, Judicial decisions.

Plaintiff railroad sought to recover damages from defendant state for diverting and lowering the waters of a river, thereby exposing and damaging plaintiff's bridge piers and supports. Plaintiff contended that diversion of river waters into a new canal, which lowered the river and exposed the piers and supports to the elements, constituted a taking and appropriation of plaintiff's property. Defendant argued that plaintiff had already been compensated for its land taken and expenses for bridge alterations and that lowering the river for improvement of navigation resulted in consequential damages for which there is no liability. Reversing a judgment for defendant, the Supreme Court of New York noted that the prior condemnation settlement did not include damage to plaintiff's bridge, but only covered the expense of required alterations. The court held that the digging of a new channel outside of the river was not an improvement of navigation within the river to which riparian rights would be subject without a claim for damages, but was an appropriation of the river's flow for use outside of the river and was compensable. (Liptak-Florida)
W71-04321

WIESNER V CITY OF ALBANY (MUNICIPAL LIABILITY FOR TYPHOID EPIDEMIC CAUSED BY DEFECTIVE PIPELINE).
224 App Div 239, 229 NYS 622-626 (1928).

Descriptors: *New York, *Public health, *Water supply, *Epidemics, Cities, Water pollution, Epidemiology, Water pollution sources, Water pollution effects, Diseases, Pipelines, Hudson River, Adjudication procedure, Legal aspects, Judicial decisions, Remedies.

Plaintiff citizen sued defendant city for negligence in causing plaintiff to contract typhoid fever. Defendant's water supply was derived from the severely polluted Hudson River. The water was purified, and pumped under the Erie Canal to the city. The pipe running under the canal, made of thin metal and encased in concrete, rusted through, and waters of the canal, as well as untreated Hudson River water which had overflowed into the canal, passed into the water supply. Defendant had notice of the defective pipe, but failed to notify its citizens that the municipal water was polluted. An epidemic of typhoid broke out. Plaintiff asserted that defendant was liable for his illness by neglecting to repair the pipe or notify its citizens. The Supreme Court of New York noted that plaintiff must show that the typhoid originated in water polluted through defendant's negligence. However, this could be satisfactorily accomplished by showing that bacilli were introduced into plaintiff's system through municipal water, allowing the jury to infer defendant's liability. Determining that the evidence amply supported the jury verdict for plaintiff, the court held defendant liable. (Hart-Florida)
W71-04322

IN RE WATERFRONT OF CITY OF NEW YORK (RIPARIAN RIGHTS SUBJECT TO PUBLIC RIGHT TO IMPROVE NAVIGATION).
231 App Div 597, 248 NYS 190-191 (1931).

Descriptors: *New York, *Riparian rights, *Eminent domain, *Navigation, Navigable waters, Riparian land, Riparian waters, State governments, Cities, Public rights, Piers, Access routes, Roads, Legal aspects, Judicial decisions.

In a city's proceedings to condemn certain riparian lands and riparian rights for navigational purposes, the Supreme Court of New York noted that riparian owners are not entitled to damages for the destruction of piers or the loss of their access to the water. Such rights and privileges are subject to the state's right to make improvements for the benefit of navigation. (Liptak-Florida)
W71-04323

WATER USE IN TENNESSEE, PART D - SUMMARY,
Tennessee Dept. of Conservation, Nashville. Water Resources; and Geological Survey, Nashville, Tenn.
For primary bibliographic entry see Field 06D.
W71-04324

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).

Hearings. Subcomm of the Comm on Gov't Operations, US House of Representatives, 91st Congress,

2nd Session, July 22, 23, Aug 4, 1970. 209 p, 2 tab, 2 chart, 1 append.

Descriptors: *Adminstrative agencies, *Federal government, *Environment, *Legislation, Ecology, Water pollution, Pollution abatement, Water pollution control, Water quality, Standards, Water pollution effects, Air pollution, Air pollution effects, Pesticides, Research and development, Costs, Coordination, Administration, Management, Planning, Water policy, Public health, Solid wastes, Effluents, Supervisory control (Power).

These hearings before a House subcommittee on government reorganization concerned President Nixon's proposal to create the Environmental Protection Agency (EPA). The President's message to Congress, which also contained a proposed National Oceanic and Atmospheric Administration, outlined the need, functions and organization of the EPA. The EPA would make possible a coordinated attack on water, air, and land pollution. It would undertake functions of many overlapping agencies including: (1) the Federal Water Quality Administration, (2) the National Air Pollution Control Administration, (3) the Bureau of Solid Waste Management, (4) the Bureau of Water Hygiene, and (5) various other agencies concerned with pesticides. Principal functions of the EPA would include: (1) establishment and enforcement of environmental protection standards consistent with national environmental goals, (2) research and data collection on pollution effects and control, (3) assisting other organizations through grants and technical assistance, and (4) assisting the Council on Environmental Quality in developing and recommending policies for environmental protection. Questions from the subcommittee centered on: (1) the need for the EPA, (2) its operation, (3) its effect on other agencies, and (4) inclusion or exclusion of various pollution problems from the agency's activities. (See also W71-04326). (Duss-Florida)
W71-04325

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
Hearings, Subcomm on Executive Reorganization and Government Research, Comm on Government Operations, US Senate, 91st Congress, 2nd Session, July 28, 29, Sept 1, 1970. 217 p, 1 tab.

Descriptors: *Administrative agencies, *Federal government, *Environment, *Oceans, Ecology, Water pollution, Pollution abatement, Air pollution, Research and development, Coordination, Administration, Water resources development, Marine fisheries, Commercial fish, Water policy, Standards, Environmental effects, Weather, Atmosphere, Water quality, Public health, Effluents, Estuarine environment, Oceanography, Natural resources, Supervisory control (Power), Legislation.

These hearings before a Senate subcommittee of the Committee on Government Operations concerned President Nixon's proposal to create the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA). The EPA would bring together in a simple organization the major federal pollution control programs in: the Department of Interior; the Department of Health, Education and Welfare; the Atomic Energy Commission; and the interagency Council on Environmental Quality. The EPA's principal functions would be: (1) to establish and enforce environmental protection standards consistent with national environmental goals; (2) to research pollution problems; (3) to assist other organizations in pollution control; and (4) to develop and recommend environmental policies. Combat water pollution would be a major part of these functions. The NOAA would bring together within the Commerce Department the major federal programs dealing with the seas and atmosphere. The function of the NOAA would be to: (1) provide a national oceanic and atmospheric program of research and development; (2) provide assistance to other governmental agencies and private institutions; and (3) insure consideration of environmental protection in development of resources. Many witnesses questioned the method of organization and goals of the two agencies, particularly the NOAA's emphasis on resource development as opposed to environmental protection. (See also W71-04325) (Duss-Florida)
W71-04326

RULES OF PRACTICE AND PROCEDURE.
Delaware River Basin Commission, Trenton, N.J.

Administrative Manual, Part 11, Revised to include Amendments through May 1, 1970. 27 p.

Descriptors: *Delware River Basin Commission, *Administration, *Administrative decisions, *Decision making, Project planning, Water resources development, River basin development, Programs, Water conservation, Non-structural alternatives, Structures, Regulation, Evaluation, Long-term planning, Short-term planning, Water policy, Pollution abatement, Water quality control, Water pollution control, River basin commissions, Interstate commissions, Delware, New Jersey, Administrative agencies, Adjudication procedure.

Part 11 of the Delware River Basin Commission's administrative manual, these regulations govern the procedure for including projects in the Comprehensive Plan and Water Resources Program. Article 1 defines the scope and concept of the six-year comprehensive plan and the procedure for including new projects and reviewing current projects. Article 2 governs the procedure for including projects in the annual Water Resources Programs. Article 3 covers: (1) classification and submission of projects for approval, (2) referral by state and federal agencies, (3) exhibits, (4) hearings, (5) objections, and (6) certification of approval. Objections to proposed projects may not be heard unless filed in detailed writing in advance of hearing. Article 4 prescribes the procedure for reviewing water quality cases. Article 5 governs: (1) the conduct of hearings, (2) timely requests, (3) joint hearings, (4) hearing schedules, (5) authority and power of hearing officers, (6) hearing procedure, (7) testimony, (8) evidentiary rules, (9) record of proceedings, (10) findings and reports, and (11) commission action. Article 6 contains definitions and general provisions as to construction of the preceding articles. (Liptak-Florida)
W71-04327

PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
146 Misc 473, 261 NYS 598-605 (1932).

Descriptors: *New York, *Ownership of beds, *Navigable waters, *Land tenure, Boundaries (Property), Lakes, Bays, Beds, Boundary disputes, Real property, Cities, Local governments, State governments, Proprietary power, Leases, Rents, Legal aspects, Judicial decisions.
Identifiers: *Patents (Land), Indians.

Plaintiff state brought action against defendant town to establish title to the beds of various navigable waterbodies. Plaintiff contended that the beds belonged to the state by virtue of its sovereignty, that prior patents to the town were void for failure to acquire title from the Indians, and that prior decisions vesting title in the town were not binding since the state was not a party. The court held that, since it did not appear that the Indians ever had any title to the property in dispute, acquisition of title from the Indians was not a condition precedent to the validity of defendant's patents. The court also held that it was against public policy for the state to assert title in land over which the town had exercised control and from which the town had realized all the rent and profits for over 200 years. Noting that the state had no valid argument, the court said that the prior decisions should be considered controlling. The state's claim was dismissed. (Liptak-Florida)
W71-04328

OYSTERMEN'S DOCK COMPANY DOWNING (LAND UNDER TIDAL WAT HELD IN PUBLIC TRUST).

232 App Div 295, 249 NYS 558-559 (1931).

Descriptors: *New York, *Ownership of *Public rights, *Tidal waters, Bays, Beds, Le Contracts, Governments, Legal aspects, Citie dicial decisions, Beds under water, Remedies, tenure.
Identifiers: *Trust doctrine.

Plaintiff dock company brought mandamus to pel defendant town supervisor to execute a lea land under the waters of Oyster Bay. The noted that submered tidewater lands are he public trust. Leasing lands under navigable waters must be in the public interest. Sinc proposed lease amounted to a conveyance o fee disguised as a lease, and had been opposed public vote, it was against public policy. The reversed the order requiring defendant to ex the lease. (Liptak-Florida)
W71-04329

BAUMHART V MCCLURE (OWNERSHIP RIPARIAN LAND AFTER SUSTAINED MERGENCE).

153 NE 211-212 (Ohio App 1926).

Descriptors: *Ohio, *Land tenure, *Accr (Legal aspects), *Boundaries (Property), Bou ry disputes, Real property, Erosion, Submerg Adjudication procedure, Riparian land, Lake Lakes, Judicial decisions, Legal aspects, Avuls

Plaintiff riparian lot owner sought to quiet ti riparian land claimed by defendant riparian o Defendant's lot was above Lake Erie when originally platted. It was later submerged f years, but had recently reappeared. Pla claimed title to the lot by accretion or reli The Ohio Court of Appeals defined accretion increase in realty by gradual deposit of material by water to create dry land. Relictio defined as an increase in realty by recessi water. Noting that the burden of proof was the claimant by accretion as against one h chain of title, the court stated that an owner' is destroyed by a disappearance of land only the land is transported beyond the owner's bo ry, or is submerged for a period precl establishment of the property's identity. Fu more, it was observed that title would n destroyed by sudden avulsion from storm. S that land lost by submergence might be regain reliction, and its disappearance by erosion co returned by accretion, the court held that pl had not sustained the burden of proving that d dant's title in the property had been perma destroyed by its submergence. Defendant's was held unimpaired. (Hart-Florida)
W71-04330

MEEKER V KAUTZ (TITLE TO ISLAND NAVIGABLE RIVER).
239 NW 27-29 (Iowa 1931).

Descriptors: *Iowa, *Islands, *Accretion aspects), *Land tenure, High water mark, R Navigable rivers, Mississippi River, Navi waters, Beds, Ownership of beds, River beds, governments, Real property, Water levels, Rip land, Riparian waters, Boundaries (Prop Boundary disputes, Legal aspects, Judicial sions, Adjudication procedure.

Plaintiff, claiming title under a patent fro state, sued to quiet title to two small islands Mississippi River. Defendant, who owned a and larger island, contended that the two sm islands were accretions to his island and that tiff's patent description covered only part o

lands. Affirming a judgment for plaintiff, the upreme Court of Iowa noted that the burden was n defendant to prove that the islands were formed y accretion, a gradual and imperceptible addition the shoreline. To prove accretion defendant was quired to show that the islands were connected to s land at ordinary high water mark. Since the idence showed that the three islands were parated by 3 to 4 feet of water when the river was feet below ordinary high water, the court held at defendant had failed to meet his burden. The urt also held that certain errors in the patent scription were immaterial, since a state patent uld not be collaterally attacked by way of fense to a quiet title suit. (Liptak-Florida)
71-04331

EHIGH AND WILKES-BARRE COAL MINING) V PITTSTON COAL MINING CO ISCHARGE OF HYDRAULIC MINING ATER INTO CONTIGUOUS MINE).
9 Pa 492, 137 A 672-673 (1927).

escriptors: *Pennsylvania, *Coal mines, Hydraulic mining water, Hydraulic mine-filling, drauliс mining, Mine drainage, Flooding, Tunls, Tunnel design, Tunnel hydraulics, Tunneling, tches, Judicial decisions, Legal aspects.

aintiff coal mine owner sought to enjoin defennt coal mine owner from draining water into his ne. Defendant dug a tunnel within 20 ft. of plain's land. To avoid the expense of draining surplus ter upward, defendant ditched the tunnel to in the water through broken rocks into plain's mine. Some 50 years earlier plaintiff's decessor's mining operation had trespassed into fendant's land, causing the cave-in resulting in broken rockpile through which the water wed. Defendant contended that, because of this spass, plaintiff came with unclean hands and uld not complain of the water. Observing that the of his predecessor 50 years earlier did not affect intiff's ability to maintain the action, the Sune Court of Pennsylvania held defendant liable granted the injunction sought. (Hart-Florida)
71-04332

OBER V TOWNE (ROAD DEPARTMENT'S ABILITY FOR INCREASING THE FLOW OF ATER OVER CONTIGUOUS LAND).
A 176-177 (Me 1928).

escriptors: *Maine, *Road construction, *Natuflow doctrine, *Condemnation, Highways, Alation of flow, Condemnation value, Compensa, Payment, Eminent domain, Right-of-way, ter injury, Erosion, Flood damage, Damages, icial decisions, Legal aspects, Remedies.

aintiff landowner sued defendant state highway artment for damage caused by excess water ving over his land. Defendant had repaired the blic road crossing plaintiff's land, thereby inasing the flow of water over plaintiff's land. ntiff did not allege that the repairs were perned negligently or maliciously. Stating that the demnation of the right-of-way included the t to maintain and improve the road, even if improvements increased the flow of water r the contiguous land, the Supreme Judicial rt of Maine observed that plaintiff's compensa for the condemnation included his compensa for the injury. The court held that plaintiff had ause of action. (Hart-Florida)
1-04333

PEAL OF PHILADELPHIA FELT CO (CONMNATION VALUE OF RIPARIAN LAND).
A 208-209 (Pa 1928).

criptors: *Pennsylvania, *Condemnation value, droelectric plants, *Dams, Eminent domain, demnation, Parks, Rivers, Riparian rights, mpensation, State governments, Administrative ncies, Judicial decisions, Legal aspects, kwater, Recreation.

Plaintiff felt company appealed from an assessment of damages for property condemned for use as a public park. The backwater from plaintiff's downriver dam extended completely through the condemned tract. Plaintiff asserted that the condemnation affected its right to maintain its dam at the present height. The park commissioners contended that there was no intent to interfere with the right to maintain the dam and that such maintenance would not interfere with the park. Determining that park use of the property would not interfere with the dam, the Supreme Court of Pennsylvania held that the board of viewers had properly disallowed damages for interference with the water rights. (Hart-Florida)
W71-04334

STATE WATER CONTROL LAW.
Virginia State Water Control Board, Richmond.

June 1970. 21 p.

Descriptors: *Water quality control, *Virginia, *Water pollution control, Pollution abatement, Water conservation, Legislation, Legal aspects, Social aspects, Water resources development, Municipal wastes, Sewage, Regulation, Water quality, Discharge (Water), Sewage disposal, Waste disposal, Abatement, Taxes.

A compilation of statutes and regulations pertaining to the abatement and prevention of water pollution in Virginia, the Virginia Water Control Law is divided into seven articles encompassing: (1) general statutory provisions; (2) the structure, power and duties of the water control board; (3) regulation of industrial establishments; (4) regulation of sewage discharges; (5) enforcement and appeal procedures; (6) offenses and penalties; and (7) pollution from boats. Regulations and requirements dealing with various aspects of sewage discharge are established by the Virginia Water Control Board. Miscellaneous offenses concerning water pollution include: (1) casting garbage into waters; (2) obstructing or contaminating Virginia waters; (3) throwing trash into or obstructing rivers, creeks, streams, or swamps; and (4) discharge of oil in certain waters. An accelerated amortization rate is established on certain facilities designed to control pollution. (Powell-Florida)
W71-04335

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
Subcomm on Conservation and Natural Resources of the House Comm on Gov't Operations, 91st Cong, 2d Sess, 1970. 2 p.

Descriptors: *Pollution abatement, *Water pollution control, *Rivers and Harbors Act, *Remedies, Wastes, Water conservation, Legislation, Water resources development, Legal aspects, Social aspects, Water law, Navigable waters, Water pollution, Water policy, Water quality control, Administration, Federal government, Federal jurisdiction.
Identifiers: *Refuse Act of 1899.

The Conservation and Natural Resources Subcommittee of the Committee on Government Operations prepared this brief outline for distribution to citizens interested in preventing pollution and enhancing the quality of United States' waters through citizen action aiding enforcement of the 1899 Refuse Act. The outline is divided into five parts. The first portion of the outline deals with what is prohibited by the Act. This section also defines the term 'refuse'. The second part of the outline covers the authorization and issuance of permits to discharge material into navigable waters. Part three of the outline lists the penalties for violation of the Act. The fourth portion of the material deals with the procedure by which citizens may seek enforcement of the Refuse Act. This portion enumerates the information which should be provided to the United State Attorney in a detailed, notarized statement. The final section of the outline discusses qui tam suits instituted by citizens where the government fails to prosecute a claim within a reasonable period of time. (Powell-Florida)
W71-04336

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
Maryland Univ., Baltimore. School of Law.
Garret ower.
Estuarine Pollution Study Series 1, Federal Water Pollution Control Administration, Mar 1970. 270 p, 1 tab, 646 ref. FWQA Contract 14-12-421.

Descriptors: *Maryland, *Virginia, *Estuaries, *Legal aspects, Interstate, Legislation, Estuarine environment, Navigable waters, Land tenure, Federal jurisdiction, Federal-state water rights conflicts, State jurisdiction, State governments, Beds, Riparian land, Riparian waters, Local governments, Interstate compacts, Political aspects, Water resources development, Water quality control, Dredging, Fish conservation, Coastal engineering, Judicial decisions.

The Chesapeake Bay is a major east coast interstate estuarine area which has many legal and management characteristics common to other estuarine areas of the United States. This report describes the historical development and resulting complex, interacting legal framework -- at the federal, state, local, and interstate levels -- which regulates development of the Bay's resources. Case studies are presented which relate this legal framework to specific estuarine management problems such as: (1) water quality, (2) withdrawals and diversions, (3) dredging, and (4) dumping. A proposed model statute is presented which may be of assistance to coastal states in improving the planning, development, management, and conservation of estuarine areas. The report is comprehensively referenced and written in a manner understandable to laymen as well as the legally or technically trained reader. (Earl-Florida)
W71-04337

TOWARDS A BETTER USE OF THE OCEAN; CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
Stockholm International Peace Research Inst. (Sweden).
W. T. Burke, R. Bierzanek, I. Brownlie, W. M. Chapman, and C. Girard.
New York, Humanities Press, 1969. 231 p, 2 tab, 263 ref, 4 append.

Descriptors: *International waters, *Law of the sea, *Continental Shelf, *Oceans, International law, Technology, Legal aspects, Marine fisheries, Foreign waters, Economic impact, Political constraints, Commercial fishing, Oceanography, Military aspects, Mineral industry, Boundary disputes, Institutional constraints, Foreign countries, Political aspects, Ownership of beds, Treaties, Research equipment, Buoys, Submarines, Judicial decisions.
Identifiers: *Ocean resources.

The main article of this symposium, a study of contemporary legal problems in ocean development, considers the burdens placed upon existing, international law by technological advances in ocean exploitation. Conflicts arising in specific areas of ocean use are identified, and the legal policy questions within each area are examined. Areas of conflict discussed include: (1) the acquisition of mineral resources, (2) acquisition and control of marine fishery resources, (3) military uses of the continental shelf and the seabed beyond, and (4) scientific research in the oceans. The consequences of claims to special rights by adjacent coastal states and the accelerating trend towards such claims are evaluated. The study also considers possible modes of regulating international fisheries and the exploitation of marine mineral resources. Varying alternatives for accomodating or restricting military use of the oceanic environment are suggested. Finally, the study examines the need for institutional innovations and international accords to protect instruments of scientific research, such as buoys and submersibles, from the restrictions

created by expanded boundary claims. In each area of conflict, the author sets forth appraisals and recommendations. Following the author's study are evaluatory comments and recommendations by seven international scholars. (Earl-Florida)
W71-04338

WATER-USE LAW IN MISSOURI,
Missouri Agricultural Experiment Station, Columbia.
Fred L. Mann, James McLarney, Robert D. Angle, and Frank Miller.
Research Bulletin 889, October 1965. 68 p, 334 ref.

Descriptors: *Missouri, *Water law, *Water utilization, *Riparian rights, Water management (Applied), Administration, Legal aspects, Water rights, Water policy, Judicial decisions, Legislation, Prior appropriation, Preferences (Water rights), Regulation, Surface waters, Streams, Watercourses (Legal), Groundwater, Hydrologic cycle, Riparian waters, Riparian land, Natural flow doctrine, Reasonable use.

Although the legislature has provided regulation of certain water-use aspects, the use of water in Missouri is governed primarily by court decisions applying common law rules. Riparian waters are those waters confined within the banks of a natural watercourse or lake, to which use and access rights attach. The Missouri courts have refused to follow a strict definition of a watercourse. Surveyed is the Missouri case law distinguishing surface waters, overflow waters, water in artificial watercourses, and subterranean waters from riparian waters. Missouri courts have adopted the doctrine of riparian rights but are not committed to either the natural flow or reasonable use theory. Riparian rights may be acquired by prescription in Missouri. Missouri case law concerning alteration of quantity and quality of water flow, flooding, artificial watercourses, navigable waters, ownership of beds, and state jurisdiction over watercourses is examined. With respect to subterranean waters, no Missouri case defines or states a position on percolating water. (Powell-Florida)
W71-04339

RAGAN V SUSQUEHANNA POWER CO (DAMAGES FOR FAILURE TO RELOCATE ROAD FLOODED BY DAM BACKWATER).
146 A 758-760 (Ct App Md 1929).

Descriptors: *Maryland, *Dams, *Roads, *Backwater, Flooding, Bridges, Hydroelectric plants, Maximum probable flood, Design flood, Overflow, Administrative agencies, Administrative decisions, State governments, Eminent domain, Condemnation, Damages.

Plaintiff landowner sued defendant power company for damages caused by defendant's failure to construct a new road to replace one overflowed by the backwater from defendant's dam. The flooding caused plaintiff's route to his property to be longer, which plaintiff alleged reduced the property's value. Defendant had agreed with the county commissioners to relocate public roads and bridges which were flooded. Plaintiff asserted that defendant and the commissioners had conspired to designate the road as private, relieving defendant of a duty to reconstruct it. The Court of Appeals of Maryland observed that the agreement did not require relocation upon new roadbeds. Since plaintiff did have access to his property, the court held that the agreement was not breached and that defendant was not liable. The court furthermore held that plaintiff had failed to prove a conspiracy to defraud. Since mere inconvenience did not constitute a taking, the court held that plaintiff's property had not been condemned. (Hart-Florida)
W71-04340

HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING TRESPASS TO DRAIN SWAMPS AND PONDS).
168 A 102-103 (Me 1933).

Descriptors: *Maine, *Legislation, *Streams, *Eminent domain, Condemnation, Damages, Ponds, Diatomaceous earth, Dredging, Legal aspects, Judicial decisions, Drainage, Channels.
Identifiers: *Constitutionality.

Plaintiff riparian landowner sued defendant landowner for trespass. Defendant wished to drain a pond upon his land to extract valuable diatomaceous earth and entered plaintiff's land to deepen the stream which drained the pond, under a statute permitting landowners to enter adjacent lands to drain such ponds. Plaintiff contended that the statute unconstitutionally permitted condemnation of private lands for private use. Determining that defendant had unquestionably taken plaintiff's land for his personal benefit under authority of the statute, the Supreme Judicial Court of Maine held the statute unconstitutional and held defendant liable for trespass. The Court noted that appropriation of property for a purpose of great benefit to the public is not for that reason a taking for a public use. (Hart-Florida)
W71-04341

PEOPLE EX REL WESTERN NEW YORK AND P RY V STATE TAX COMM'N (ASSESSMENT OF RAILROAD BRIDGE AS A SPECIAL FRANCHISE).

244 NY 596, 155 NE 911-912 (1927).

Descriptors: *New York, *Railroads, *Bridges, *Assessments, Taxes, Navigable rivers, Non-navigable waters, Beds, River beds, Ownership of beds, Riparian land, Riparian rights, Administrative agencies, Administrative decisions, Legislation, Compensation, Condemnation, Eminent domain, Judicial decisions, Legal aspects, Government finance.

Plaintiff railroad company brought action to prevent assessment of its bridges across a river as a special franchise. The river was non-navigable in its natural state. Accordingly, title to the beds and shores were alienated by the state. Plantiff purchased a right-of-way in these lands and erected a bridge. Legislation was later enacted declaring the river navigable. Defendant tax commission accordingly assessed plaintiff's bridge as a special franchise. The Court of Appeals of New York observed that the statute, as applied to plaintiff in these circumstances, amounted to a taking without compensation. Therefore, plaintiff's right to erect a bridge was held not to be a special franchise. (Hart-Florida)
W71-04342

GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON—NAVIGABLE RIVER).
151 SE 161-165 (Sup Ct App Va 1930).

Descriptors: *Virginia, *Dams, *Design flood, *Administrative decisions, Dam construction, Flood control, Hydroelectric plants, Maximum probable flood, Ponding, Administrative agencies, Adjudication procedure, Judicial decisions, Legal aspects, Navigable rivers, Navigable waters, Non-navigable waters, Rivers, Interstate.
Identifiers: *Interstate commerce.

Plaintiff garden club contested defendant service company's petition to State Corporation Commission for erection of a dam on a non-navigable river. The application was opposed by another company whose plant would be flooded by the design flood. That company induced defendant to lower the dam height slightly to avoid flooding its plant. Since the river was non-navigable, the Commission had jurisdiction of the petition only if defendant's would affect interstate commerce. Defend original application was subject to the Cor sion's jurisdiction. With the lowered height, merce was not affected, and the Commissio nied jurisdiction of the petition. Plaintiff conte that defendant had no right to lower the dam h to divest the Commission of jurisdiction. Deter ing that the change was made for practical poses, rather than to deprive the Commission risdiction, the Supreme Court of Appeals of ginia held that the Commission properly dism the petition for lack of jurisdiction. (Hart-Flori
W71-04343

KIRK V PROVIDENCE MILL CO (SURF WATER RIGHTS SUBJECT TO STA RIGHT TO ABANDON AND DRAIN CANAL

279 US 807, 49 Sup Ct 511 (1929).

Descriptors: *Canals, *Water rights, *Water tracts, *Surplus water, Contracts, Prefere (Water rights), State governments, Ohio, Na tion, Legal aspects, Judicial decisions, P rights, Eminent domain, Condemnation.

Plaintiff riparian owner sued to enjoin defen state from draining a canal, thereby destro plaintiff's surplus water rights in the canal. P tiff's predecessor had granted the canal proper the state in exchange for a perpetual grant of plus water rights. Plaintiff contended that dra the canal was a taking of property without process or compensation and interfered wit contract rights. Reversing a judgment for plai the United States Supreme Court held that grant of water rights was subject to the rese power of the state to abandon the canal and de the property to purposes other than naviga (Liptak-Florida)
W71-04344

DUNBAR V BD OF COMM'RS OF ALBEMA DRAINAGE DIST (FAILURE OF DRAIN DISTRICT TO ERECT DAM CAUSES C FLOODING).
198 NC 487, 152 SE 386-387 (1930).

Descriptors: *Flood damage, *North Caro *Dams, *Drainage, Crops, Damages, Water in Administrative agencies, Canals, Erosion, celerated erosion, Superimposed drainage, Juc decisions, Legal aspects, Floods.

Plaintiff farmowner sued defendant drainage trict for damage to his crops caused by floo Plaintiff's farm was contiguous to the drai canal of the district adjacent to defendant dis In an earlier action between these two drainage tricts, defendant was ordered not to discharge water into the canal contiguous to plaintiff's than that which flowed into it naturally from d dant. To accomplish this, defendant was order construct a dam. A temporary dam was built p ing completion of a permanent structure. The porary dams were washed out and not re Nothing was done to erect a permanent dam. P tiff contended that defendant negligently faile restore the temporary dam or erect the perma dam, causing the canal to overflow and damag crops. Affirming the lower court's judgment Supreme Court of North Carolina held defen liable for plaintiff's injury. The court noted tha fendant would not have been liable in the abs of negligence. (Hart-Florida)
W71-04345

POST V WILKES-BARRE CONNECTING (DESCRIPTION OF CHANNEL AS PROPE BOUNDARY WHERE BED LATER DRIES U
133 A 377-379 (Pa 1926).

Descriptors: *Pennsylvania, *Ownership of b Islands, *Boundary disputes, Navigable ri Boundaries (Property), Navigable waters, Ri

iver beds, Channels, Banks, Sediments, Surveys, Mapping, Riparian land, Riparian waters, Riparian ights, Legal aspects, Judicial decisions, State overnments, Railroads, Excavation, Embankents, Sands, Gravels.

laintiff riparian owner brought action against dendant railroad for trespassing on and removing il from land claimed by plaintiff. Plaintiff's deed alled for a river as his property line, and the chanel adjacent to plaintiff's land had since filled in out an island in midstream. Plaintiff contended that e now owned up to the channel on the opposite de of the island and that defendant had wrongly removed soil and built an embankment in hat was the old channel. Reversing a judgment for aintiff, the court held that although descriptions monuments ordinarily prevail over courses, stances, and quantity, a manifestly inaccurate onument will be discarded where another monuent, the bank of the original channel, more corctly corresponds to the described courses, stances, and quantity. The court also noted that, e river being navigable, title to the bed was vested the state, which granted the franchise to defennt. Plaintiff's deed could not be construed to nvey title to state property. (Liptak-Florida)
71-04346

RE LANDS ON UPPER NEW YORK BAY ASEMENT IN SUBMERGED LANDS EXTINUISHED BY RESOLUTION OF MUNICIPAL OUNCIL).
5 App Div 438, 214 NYS 234-236 (Sup Ct 26).

scriptors: *New York, *Condemnation, *Beds der water, *Cities, Beds, Land tenure, Real proty, Ownership of beds, Easements, Roads, Railds, Eminent domain, Legal aspects, Judicial cisions.

intiff city sought to condemn lands under water ending from a street to the pierhead line. The preme Court of New York had formerly decided t since the street extended to the waters edge en the city charter took effect, the city had an ement in the submerged lands between the et lines as extended to the pierhead line. On rgument, it was pointed out that the submerged tion of the street had been closed by resolution a municipal council. Defendant transit company ued that whatever easement existed in the subrged land was extinguished by the resolution, could not have existed at the time of conmnation. Plaintiff argued that the conditions essary for closing the street had not been sfied, and that therefore the resolution did not nguish the easement. Presuming that the mupal resolution had satisfied the conditions for ing the street, the court held that the closing of street extinguished plaintiff's easement therein that there was no public easement in the lands demned. (Hart-Florida)
1-04347

)PLE V ZORA REALTY CO (ATTEMPT TO CLARE PATENT IN SUBMERGED LANDS D FOR NONUSE).
Misc 523, 220 NYS 40-41 (Sup Ct 1926).

criptors: *New York, *Land tenure, *States, vnership of beds, Beds, Beds under water, eficial use, High water mark, Low water mark, rian land, Legal aspects, Judicial decisions.

ntiff state brought action to declare a patent of s between high and low water mark a nullity. endant owned the upland adjacent to the uted property. The patent, issued to defendant years previously, reserved to the people the to use the premises until the land was used for merce or the beneficial use of the patentee. No limit within which the land must have been zed was expressed in the patent. As defendant never utilized the land for any purpose, plaintontended that the delay was unreasonable, and sought to declare the patent void for nonuse. Holding that the conveyance was in fee, taking effect as to title, at the time of the conveyance, and as to enjoyment when utilized, the Supreme Court of New York granted defendant's motion to dismiss. (Hart-Florida)
W71-04348

IN RE INWOOD HILL PARK (CONDEMNATION OF CITY'S OWN LAND FOR PARK).
219 App Div 478, 220 NYS 298-305 (Sup Ct 1927).

Descriptors: *New York, *Condemnation, *Condemnation value, *Cities, Beds, Beds under water, Ownership of beds, Parks, Land use, Eminent domain, State governments, Legal aspects, Judicial decisions, Land tenure, Compensation, Recreation.

Plaintiff city sought to condemn its own land for a park. The lower court refused to allow an award for plaintiff's land. The submerged land was located between the high water mark and the federal bulkhead line. The Supreme Court of New York said that plaintiff could use its waterfront property for any public purpose and that since the state was empowered to dispose of submerged lands, it could permit plaintiff to do likewise. Holding that plaintiff might condemn the land and assess the award against the property, the court noted that the compensation should be the actual value of the condemned land. Furthermore the court held that a statute declaring plaintiff's rights in the property inalienable did not preclude condemnation. (Hart-Florida)
W71-04349

WHITE V STATE (VALIDITY OF GRANT OF SUBMERGED STATE LANDS).
239 So 2d 484-488 (La App 1970).

Descriptors: *Louisiana, *Ownership of beds, *Navigable waters, *State governments, Beds, Bays, Gulf of Mexico, Land tenure, Leases, Proprietary power, Boundaries (Property), Regulation, Public lands, Public rights, Administrative agencies, Legal aspects, Judicial decisions, Beds under water, Legislation.

Plaintiff landowner sued defendant state to regain possession of a portion of the bed of a navigable bay. Plaintiff based her title on a state transfer of the land to a levee district, a sheriff's sale ordered by the levee district, and two state patents confirming the sheriff's sale. Defendant had subsequently granted mineral leases in the property to an oil company. Defendant contended that the state transfers and patents were null and void because they violated state statutes prohibiting the sale of submerged sovereignty lands. Affirming a judgment for defendant, the Court of Appeal of Louisiana held the first transfer to the levee district void. Statute only authorized the transfer of land, not beds of navigable water. The sheriff's sale was declared void because the levee district had no authority to order the sale. The two state patents were void because they were in violation of a statutory prohibition against the sale or grant of submerged bottoms connected with the Gulf of Mexico. (Liptak-Florida)
W71-04350

6F. Nonstructural Alternatives

FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02E.
W71-03932

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W71-04143

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W71-04144

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W71-04145

ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
Tennessee Univ., Knoxville. School of Engineering.
For primary bibliographic entry see Field 04A.
W71-04270

6G. Ecologic Impact of Water Development

APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
Engineering Science, Inc., Oakland, Calif.; and General Behavioral Systems, Los Angeles, Calif.
For primary bibliographic entry see Field 05G.
W71-04025

NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE: HYPOTHESES AND MODELS,
Clark Univ., Worcester, Mass. Graduate School of Geography.
Robert W. Kates.
Working Paper No 14, Natural Hazard Research, 1970. 26 p, 5 fig, 14 ref.

Descriptors: *Model studies, *Hazards, Ecology, Computers, Simulation analysis, Management, Decision making, Drought, Water supply.
Identifiers: *Global hypotheses, Human adjustments, East Africa.

This paper was one in a series on research progress in the field of human adjustments to natural hazards. A rudimentary model of the short-run process of adjustment constituted the major focus of the study. The models sought to fashion major hypotheses of hazard behavior into structures capable of computer simulation. Under the global hypotheses of natural hazards such topics as man-nature interaction, techno-social stages, hazard differences, decision-maker differences, individual differences, perception of hazard, awareness of adjustments, and evaluation of adjustments were described. Specific qualities for a model useful for hazard research suggested were that it should be: parsimonious, conservative, flexible, useful, and aesthetically pleasing. The modeling of the ecological perspective within a general systems framework was shown as a single cross-section of space and time. The model contained a human use system and a natural events system which interacted to pose a natural hazard. This generated a set of hazard effects and led to a need for adjustment processes control by use of a managerial adjustment decision model or an aggregate adjustment decision model. The progress being made in modeling drought in East African smallholder agriculture was used as an illustration of the general model other specific hazards mentioned that the human use system could be related to were urban residential development, municipal water supply, etc. (Kriss-Cornell)
W71-04032

NATURE'S LAW AND MAN'S ETHIC,
Army Engineer District, Omaha, Nebr. Design Branch.
For primary bibliographic entry see Field 04C.
W71-04069

A NATIONAL POLICY FOR THE ENVIRONMENT: SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91st CONGRESS. 1st SESSION.
Library of Congress, Washington, D.C. Legislative Reference Service.
For primary bibliographic entry see Field 06E.
W71-04092

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
For primary bibliographic entry see Field 06E.
W71-04106

07. RESOURCES DATA

7A. Network Design

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
Geological Survey, Albany, N.Y.
Kenneth I. Darmer.
Geological Survey Open-file report, 1970. 29 p, 5 fig, 8 tab.

Descriptors: *Streamflow, *Hydrologic data, *Project planning, *New York, Evaluation, Data collection, Gaging stations, Time series analysis, River basins, Network design, Data processing, Watershed management.
Identifiers: *Streamflow data program (N.Y.).

Available streamflow information for New York has been evaluated to provide guidelines for planning needed future programs of data collection and analysis. The evaluation followed three basic steps: (1) quantitative definition of long-term goals for streamflow information, (2) examination and analysis of available data to determine which goals have been attained, and (3) consideration of alternate programs and techniques to most efficiently reach the unattained goals. This evaluation indicates that available data are sufficient for attaining several goals and that significant changes are desirable in the present data-collection program. A future program is proposed for both data collection and data analyses to reach the unattained goals. A map, scale 16 mi per in, shows gaging stations in operation and proposed. Symbols indicate type of station, as for long-term trend, current purpose, and design and planning. (Lang-USGS)
W71-03933

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 02B.
W71-04020

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
Peter Hutchinson.
Journal of Hydrology, Vol 12, No 1, p 1-14, December 1970. 14 p, 6 fig, 2 tab, 11 ref.

Descriptors: *Network design, *Rain gages, *Distribution patterns, *Topography, Mountains, Statistical methods, Gaging stations, Data collections, Hydrologic data, Meteorological data, Stations.
Identifiers: *Rain gage networks, *New Zealand.

The areal variability of rainfall is affected by the nature of the terrain, and it is necessary to establish a greater network density in mountainous areas than in flat ones. This paper examines the possibility of establishing quantitative relationships between the 'local relief', used as a measure of the ruggedness of the terrain, and the required network density for given accuracies of estimates for mean catchment rainfall. This is done by comparing the variability of rainfall on three climatically similar areas. Two are in New Zealand, and one is a theoretically derived flat area which is subjected to a statistically similar rainfall regime. The areas chosen were a mountainous area, Coastal Otago, New Zealand, and a flat to rolling area, Coastal Canterbury, New Zealand. The intensity and distribution of 172 actual storms on the two real areas taken on a daily basis were thus mapped, and two parameters, the maximum daily intensity and mean diameter, were measured for each storm. (Knapp-USGS)
W71-04122

7B. Data Acquisition

MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
New Zealand Forest Service, Wellington. Protection Forestry Branch.
Hans M. Keller.
New Zealand Ministry of Works, Water and Soil Division Miscellaneous Hydrological Publication No 2, 1969. 10 p, 1 fig, 2 tab, 5 ref, 3 append.

Descriptors: *Tracers, *Discharge measurement, *Tracking techniques, *Dye releases, Stream gages, Water measurement, Discharge (Water), Analytical techniques.
Identifiers: *Dye-dilution method.

Field and laboratory procedures are given for chemical gaging by the dye-dilution method, using sodium dichromate and a 2-gallon injection container. Injecting at a constant rate, the stream discharge is equal to the dilution ratio multiplied by the injection rate. Practical hints are given for the calibration of the injection rates, the preparation of the initial solution, the precautions to be taken in the field, and the acquisition of quick but accurate results in the laboratory. Forms for use in the field as well as for the analysis in the laboratory are proposed. With clean and careful handling of equipment and chemicals standard errors of about 2 1/2 percent should be obtained. In turbulent mountain streams and small rivers this method has been found suitable, inexpensive, and relatively quick. (Knapp-USGS)
W71-03930

USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
Pan American Petroleum Corp., Tulsa, Okla. Research Center.
Edward D. Pittman, and Robert W. Duschatko.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1153-1157, December 1970. 5 p, 2 fig, 15 ref.

Descriptors: *Porosity, *Electron microscopy, *Permeability, *Porous media, *Pores, Interstices, Aquifers, Analytical techniques, Laboratory tests, Percolation, Groundwater movement, Voids.
Identifiers: *Pore geometry.

Various types of pore casts, replicas of void space, useful for the study of pore geometry can be prepared from rocks impregnated with plastic. Conventional light microscopes are suitable for examination of most pore casts; however the scanning electron microscope is definitely superior and is essential for good photographic illustrations. Study of pore casts provides information on the distribution and shape of pores and interconnecting passageways that influence permeability and control the flow of fluids. (Knapp-USGS)
W71-03946

A MECHANICAL DEVICE FOR RELEASI FLUORESCENT TRACERS,
Geological Survey of India, Calcutta. Mari Geology Unit.
P. C. Shrivastava.
Marine Geology, Vol 9, No 5, p M43-M4 December 1970. 4 p, 2 fig, 11 ref.

Descriptors: *Tracers, *Dye releases, *San *Bed load, *Sediment transport, Bottom se ments, Equipment, Instrumentation, Taggi Tracking techniques, Fluorescence.
Identifiers: Tracers (Fluorescent sand).

An oil drum may be made into a mechanical dev for the release of more than 250 kg of fluoresc tracer sand under water on the bottom. The dev basically consists of a drum with a false-bottom a a release mechanism which opens the bottom touching the sediment surface. When the drum lifted a little, the false-bottom opens allowing tracer sand to deposit on the bottom at the se ment surface. The drum has been used successfu in a number of tracer investigations of the Geolo cal Survey of India in varying operational con tions at sea and in tidal estuaries where the curre were very strong. (Knapp-USGS)
W71-03949

ESTIMATION OF SEA SURFACE TEMPER TURE FROM SPACE,
Michigan Univ., Ann Arbor. Inst. of Science a Technology.
D. Anding, and R. Kauth.
Remote Sensing of Environment, Vol 1, No 4 217-220, December 1970. 4 p, 6 fig, 1 tab, 3 r NASA Contract No NAS 12-2117.

Descriptors: *Water temperature, *Remo sensing, *Infrared radiation, Satellities (Artificia Data collections, Weather forecasting, Synop analysis.
Identifiers: *Infrared radiometry.

A procedure for obtaining improved estimates water surface temperature uses spatially scanni space-borne systems to perform simultaneo radiometric measurements in two wavelength int vals in the thermal infrared atmospheric-wind spectral regions. The procedure reduces errors the estimate of water surface temperature caus by haze and water vapor effects from approxima ly 2.0 deg C to approximately 0.15 deg C. (Knap USGS)
W71-03959

RADIOMETRIC INVESTIGATIONS ON TI BEACH AT THE MOUTH OF THE KU RIVER,
For primary bibliographic entry see Field 02J.
W71-03962

REMOTE GROUNDWATER LEVEL METE FOR BOG STATIONS,
V. I. Yakovlev.
Translated from Trudy Gos Gidrol Inst-ta, No 1 p 70-79, 1969. Soviet Hydrology: Selected Pape No 5, p 442-449, 1969. 8 p, 6 fig.

Descriptors: *Bogs, *Water levels, *Telemet *Observation wells, *Gages, Water level fluctu tions, Instrumentation, Surveys, Data collectio Gaging stations, Stations, Water wells.
Identifiers: Bog water-levels.

A new remote-reading meter for measuring wa levels in bogs consists of several sensors, a cont panel with power supply sources, and a commu cation line. Float sensors (up to 10), which p ceive the changes in groundwater level, are stalled in measuring wells. The control panel located in the station building. It signals the we and measures the groundwater levels at their sit The scale readings give the direct values of level in the wells from the bog surface and do require further processing. There is no need

ating and thermally insulating the well after each servation in winter. (Knapp-USGS)
71-03966

)D-MOUNTED BOTTOM GRAB,
Ya. Solov'yev.
anslated from Trudy Gos Gidrol Inst-ta, No 172, 6-99, 1969. Soviet Hydrology: Selected Papers, ie No 5, p 450-452, 1969. 3 p, 2 fig.

scriptors: *Bottom sediments, *Sampling, edging, Equipment, Sediments, Mud, Sands.
ntifiers: *Bottom-sediment samplers.

od-mounted bottom grab is designed to sample tom sediments 30-50 mm thick without disturb- structure. The instrument takes samples of non- esive silt and sandy-gravelly deposits from the tom of rivers, canals, lakes, and reservoirs in er depths of up to 2 m and at flow velocities to 2 ec. The volume of the sample when the grab is is 300 cc. The device weights 3.5 kg and mea- es 450 x 159 x 132 mm. The bottom grab is gned to operate with one or two sets of rometric rods. The operating principle of the om grab is based on the mechanical separation he sediment sample from the bottom of a body ater by a rotating scoop. (Knapp-USGS)
1-03967

CTROPHOTOMETRIC DETERMINATION CHLORATE ION,
souri Univ., Columbia. Dept. of Chemistry.
primary bibliographic entry see Field 02K.
1-03994

TED STATES COAST GUARD OCEANO- APHIC SENSOR STUDY. VOLUME I. TE-OF-THE-ART OF OCEANOGRAPHIC D METEOROLOGICAL SENSORS, TUTORI- DISCUSSION,
s Instruments, Inc., Dallas. Services Group.
ert J. Gaillard, Kenneth I. Heldebrandt, Robert Crosby, and Thomas Cass.
lable from NTIS as AD-711 322, $3.00 in r copy, $0.95 in microfiche. Rept. No TI- 9-1a, 21 May 70. 213 p, 105 ref. Contract -CG-90505-A.
tifiers: *Sensors, State-of-the-art reviews, teorological parameters, Sensors, *Oceano- hic data, Transducers, Underwater sound pment, Pressure gages, Optical instruments, istors, Oceanographic equipment, Digital ms, Specifications, Probes, Coast Guard rch.

volume presents the findings of the task by nting Coast Guard operational requirements summarizing conclusions in a descriptive ation for each parameter. The present state- e-art of oceanographic sensor technology is ated as related to the operational require- s established by the Coast Guard as a basis for tudy. These operational requirements are, in selves, ambitious goals. However, as a result e knowledge gained in performing this study, equirements may be scaled; alternatively, by ifying the inability of present instruments to the requirements, an incentive is established complishing the necessary development work d to meet the goal. Measurement discussion ovided for each parameter to be used as ground information for the prospective instru- user. There are also brief general discussions gnal conditioning and encoding techniques n power sources. The measurement of each neter is discussed in the following sequence: ral, indicating usual measurement require- and defining (where deemed necessary) the associated with the measurements; Trans- types associated with the measurements; and of-the-art, frequently including some specu- about the course of future developments. discussion of each measurement is not in- d to be comprehensive but only tutorial to the that a person involved with the measurement for the first time can comprehend the type, purpose, and techniques utilized to make the measurement. For those readers who wish to pursue the subject in greater depth, there is an extensive bibliography of material related to each measurement. The final section indicates the relative costs of different measurement techniques for each parameter. It does not provide actual price information because price is so highly dependent on the terms of a specific purchase order. (See also W71-04010 thru W71-04014)
W71-04009

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas. Services Group.
Robert J. Gaillard, Kenneth I. Heldebrandt, and Robert M. Crosby.
Available from NTIS as AD-711 323, $3.00 in paper copy, $0.95 in microfiche. Report No TI-59009-1b, 21 May 70. 354 p. Contract DOT-CG-90505-A.
Identifiers: *Sensors, State-of-the-art reviews, *Meteorological instruments, Catalogs, *Oceanographic data, Sensors, Optical instruments, Underwater light, Underwater sound, Ocean currents, pH, Salinity, Underwater communication systems, Dew point, Television communication systems, Atmospheric temperature, Cloud cover, Power supplies, Costs, Operation, Coast Guard research.

The primary function of Volume II is to present catalog listings indicating a broad spectrum of available off-the-shelf hardware. Proprietary interest has unfortunately prevented the inclusion of several state-of-the-art sensors in the catalog listings. Inadvertent omissions of available sensors and recent advances in sensor technology may also have occurred. By questionnaires and telephone calls, 178 manufacturers were contacted; 100 responded. Similarly, 58 questionnaires were mailed to users of oceanographic instruments, with 20 replying. Visits were made to major manufacturers and users to amplify material received and to ascertain the direction of development not yet published. Additionally, all catalog sheets were forwarded to the manufacturer for his final review before being incorporated into the catalog; therefore, all accuracy statements in the catalog section are those currently being quoted by the manufacturer. This report summarizes the state-of-the-art of oceanographic and meteorological instrument technology in the year 1970 and provides the bases by which, if maintained, an up-to-date catalog of sensor availability can be referenced by future designers. (See also W71-04009)
W71-04010

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
Robert M. Crosby, Frank H. MacDonald, Thomas R. Livermore, and William Gumma.
Available from NTIS as AD-711 325, $3.00 in paper copy, $0.95 in microfiche. Report No Ti-59009-2, 21 May 70. 123 p, 28 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, Protection, *Oceanographic data, Sensors, *Meteorological parameters, Corrosion, Fouling, Hydrostatic pressure, Vibration, Thermal shock, Survival, Radiofrequency interference, Coast Guard research, Sea water environment.

Task 2 describes the operational, transport, and storage environments for oceanographic and meteorological field instruments. The study resulted in recommendations for environmental protection and called attention to areas needing further work in order to accomplish adequate sensor protection at sea. (See also W71-04009)
W71-04011

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
Wilton J. Daniel, Jr., and Jerry R. Yeargan.
Available from NTIS as AD-711 326, $3.00 in paper copy, $0.95 in microfiche. Report No 59009-3, May 21, 1970. 165 p, 55 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, *Data transmission systems, *Oceanographic data, Sensors, *Meteorological parameters, Data processing systems, Signal-to-noise ratio, Amplitude modulation, Bandwidth, Multiplex, Stabilized platforms, Buoys, Underwater, State-of-the-art reviews, Tables, Coast Guard research, Data acquisition.

The report examines the problem of transmitting oceanographic data from underwater sensors to a variety of surface platforms as constrained by operational requirements set forth by the United States Coast Guard. Recommendations concerning a system to meet these requirements are made. The report also examines the formats necessary to convey the information collected from the platforms to users of both perishable and archived data. (See also W71-04009)
W71-04012

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
P. David Call, and J. Daniel Wilton, Jr.
Available from NTIS as AD-711 327, $3.00 in paper copy, $0.95 in microfiche. Report No 59009-4, June 3, 1970. 54 p, 9 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, Standarization, *Oceanographic data, Sensors, *Meteorological parameters, Design, Standards, Specifications, Reliability (Electronics), Reliability, Maintainability, Coast Guard research.

The report examines the areas in which oceanographic sensors can be standardized to meet the operational requirements set forth by the United States Coast Guard. Recommendations are made for areas in which cost reductions can be realized through the use of standards. (See also W71-04009)
W71-04013

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments Inc., Dallas. Services Group.
Frank H. MacDonald, Lawrence B. Sullivan, and Thomas R. Livermore.
Available from NTIS as AD-711 328, $3.00 in paper copy, $0.95 in microfiche. Report No TI-59009-5, May 31, 1970. 193 p, 6 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, Reliability, *Oceanographic data, Sensors, *Meteorological parameters, Performance (Engineering), Environmental tests, Production control, Handling, Storage, Transportation, Design, Coast Guard research.

Task 5 was concerned with the development of test and calibration techniques required to measure the sensor compliance with the performance, mechanical, and electrical specifications. A test program was written that provides for a rigorous examination of each basic sensor design as it applies to performance in the operational environment and its ability to survive the environmental imposed by storage, transportation, predeployment, and deployment handling. (See also W71-04009)
W71-04014

NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
California Univ., Berkeley.

J. Kumar.
World Oil, Vol 172, No 2, p 38, February 1, 1971. 1 p, 4 ref.

Descriptors: *Permeability, *Electrical well logging, Resistivity, Borehole geophysics, Aquifers, Porosity, Porous media, Saturated flow.
Identifiers: Specific permeability.

Specific permeability can be found quickly and easily from electric log data using an empirical formula developed from experimental work with several different types of sandstones. Results compare closely with core analysis in many cases. This equation is valid only for clean (shale free) and preferentially water wet sands. The solution to this equation is plotted on an accompanying chart. (Knapp-USGS)
W71-04110

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
Scott Polar Research Inst., Cambridge (England).
For primary bibliographic entry see Field 02C.
W71-04112

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
Aston Univ., Birmingham (England).
T. R. E. Chidley, and K. M. Keys.
Journal of Hydrology, Vol 12, No 1, p 15-24, December 1970. 10 p, 4 fig, 2 tab, 2 ref.

Descriptors: *Rain gages, *Rainfall, *Depth-area-duration analysis, *Distribution patterns, Data processing, Hydrologic data, Meteorological data, Data collections, Statistical methods, Least squares methods, Monte Carlo method, Isohyets.
Identifiers: *Rainfall distribution.

A polynomial surface is fitted to the recorded rainfall for a given time period. This polynomial is integrated over the area of interest. The result is a set of weights for each gage which, when multiplied by the observed rainfall at each gage give the total volume of rainfall on the area. Once the weights have been determined for a given gage network and area the method is suitable for hand computation. (Knapp-USGS)
W71-04123

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
D. Chandrasekaran, and N. S. Lakshmana Rao.
Journal of Hydraulic Research, Vol 8, No 4, p 395-402, 1970. 8 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Calibrations, *Weirs, *Discharge measurement, *Stream gages, *Stage-discharge relations, Discharge (Water), Surface waters, Streamflow.
Identifiers: *Weirs (Logarithmic section).

Logarithmic weirs in which discharge varies as the logarithm of head, have less relative error in discharge computation for a given relative error committed in head measurement than other weirs. It is desirable to have universalized coordinates of complicated weir profile equations, especially when a trial and error procedure is involved in the selection of a suitable size of a particular type of weir for measuring a specific discharge. Universalization of the coordinates of logarithmic weirs was calculated and tabulated. (Knapp-USGS)
W71-04127

ISOTOPE HYDROLOGY, 1970.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W71-04133

DETECTION OF PRECIPITATION BY RADAR,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 27-43, 1970. 17 p, 3 fig, 2 tab, 20 ref.

Descriptors: *Remote sensing, *Radar, *Weather forecasting, *Weather patterns, *Precipitation (Atmospheric), Instrumentation, Reviews, Meteorology.
Identifiers: *ECAFE, *Asia.

General factors which affect the use of radar for the detection of precipitation are reviewed. The common method used in the measurement of the rate of precipitation is based on the statistical relationship between the intensity of precipitation and the reflected power from the precipitation elements received by the radar. Radar is especially useful for detecting and measuring precipitation in areas where rain gages are sparsely distributed or where localized heavy rainfall frequently occurs. Since the radar system usually permits an integration of precipitation amounts over time and area to be made by electronic or other means, its application is of particular importance in hydrological operations such as flood forecasting, dam control and others. (Knapp-USGS)
W71-04154

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
For primary bibliographic entry see Field 02B.
W71-04158

REARING DEVICES FOR STREAM INSECT LARVAE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
William T. Mason, Jr., and Philip A. Lewis.
The Progressive Fish-Culturist, Vol 32, No 1, p 61-62, January 1970. 2 fig, 1 ref.

Descriptors: *Laboratory techniques, *Larvae, *Laboratory equipment, Mayflies, Caddisflies, Midges, Insects, Aquatic insects.
Identifiers: *Rearing device, Odonates.

Photographs and descriptions are given for two types of stream larvae rearing devices, an aquarium and magnetic stirrer, and a gravity flow device. These devices are used in the Analytical Quality Control Laboratory of the Federal Water Quality Administration for rearing stream mayflies, caddisflies, midges, and odonates. Procedures for setting up the devices and for rearing the larvae are described. (Little-Battelle)
W71-04190

EVALUATION REPORT 1: AUTOMATIC BEAKER SAMPLE CHANGER,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
L. B. Lobring, and R. L. Booth.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. January 1970. 5 p, 2 fig, 2 tab, 1 ref.

Descriptors: *Chemical analysis, *Automation, *Laboratory equipment, Surface waters, Cost, Comparison, Time, Hydrogen ion concentration, Fluorides.
Identifiers: *Beaker Butler.

The Beaker Butler, manufactured by Vision Laboratories, Inc., Oriskany, New York, is a prototype sample changer that presents liquid samples to a variety of electrodes. To evaluate the potential use of this equipment for routine analyses, san were analyzed using this equipment as we manual methods. The results, which are includ tables, show that the automated step gave re comparable to manual methods with a signif reduction in cost and man hours. (Little-Battel
W71-04192

USE OF A FLOATING PERIPHYTON S PLER FOR WATER POLLUTION SURV LANCE,
Federal Water Pollution Control Administra Cincinnati, Ohio. Analytical Quality Control L
For primary bibliographic entry see Field 05B.
W71-04194

METHODS OF COLLECTION AND ANAL OF PLANKTON AND PERIPHYTON SAMP IN THE WATER POLLUTION SURVEILLA SYSTEM,
Federal Water Quality Administration, Cincin Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04195

ELIMINATION OF 'MEMORY' PEAKS COUNTERED IN AQUEOUS-INJECTION CHROMATOGRAPHY,
Federal Water Pollution Control Administra Cincinnati, Ohio. Analytical Quality Control L
Ronald C. Dressman.
Journal of Chromatographic Science, Vol 8, p May 1970. 2 fig, 4 ref.

Descriptors: *Gas chromatography, *Analy techniques, Laboratory equipment, Phenols, ganic matter.
Identifiers: *Chemical interference, Me peaks.

The source was investigated of 'memory p which interfere with analysis during gas chroma raphy. The tests were conducted using phenols organic acids. The results indicated that the m portion of the 'memory peaks' resulted from dup in the injection port. A small portion, app mately 4% of the original response, was attrib to sorption at the head of the column. An adva injection port was designed such that the ca gas would sweep the entire injection chambe that 'memory peaks' would be prevented or at greatly reduced. On-column injection was bined with this design to further eliminate the sibility of sorption of material on the metal su of the injection block since use of such ma could also result in 'memory peaks'. Tests usin column injection with an injection port effect prevented 'memory peaks' produced by phe and eliminated the need for water flushing each sample or standard injection. In the case o ganic acids, the system reduced the 'me peaks' to about 4% of the original response. T peaks were completely eliminated with just water flush. The redesigned injection block is trated. (Little-Battelle)
W71-04196

ANALYTICAL INSTRUMENTS IN WA POLLUTION CONTROL,
Federal Water Pollution Control Administra Cincinnati, Ohio. Analytical Quality Control L
For primary bibliographic entry see Field 05A.
W71-04205

A LIMESTONE-FILLED, ARTIFICIAL S STRATE SAMPLER-FLOAT UNIT FOR C LECTING MACROINVERTEBRATES LARGE STREAMS,
Federal Water Pollution Control Administra Cincinnati, Ohio.
William T. Mason, J. B. Anderson, and George Morrison.
The Progressive Fish-Culturist, Vol 29, No 2, 1967. 74 p, 2 fig.

Descriptors: *Macroinvertebrates, *Sampling, Limestone, Equipment, Floats, Sampling.
Identifiers: *Artificial substrates, Euphotic zone, Basket sampler, Sample preservation, FWQA methods.

The Water Pollution Surveillance System uses a cylindrical, welded-wire, chromium plated 'Bar-B-Q' basket filled with limestone and suspended from a polyurethane filled float to collect macroinvertebrates in large streams. The basket is 7 inches in diameter and 11 inches long. Experience indicates that the optimum exposure is about 6 weeks at a 5 foot euphotic zone depth. The organisms are removed from the rocks in water with a stiff-bristled brush, washed in a No. 30 Sieve, bottled, and preserved in 70 percent ethanol or 5 percent formalin. Macroinvertebrates are recorded as number-per-sampler. (McCann-Battelle)
W71-04219

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. De Byle.
USDA Forest Serv Res Note INT-127, December 1970. 8 p, illus.

Descriptors: *Freezing, *Soil temperature, *Soil moisture meters, *Soil water, Snow cover, Thermal properties, Frozen soils, Permafrost, Thawing, Frozen ground, Heat transfer, Instrumentation, Measurement, Estimating, Nuclear moisture meters, Utah.

During two winters (1966-67 and 1967-68) periodic determinations were made of soil temperatures and ice column depths in four types of tubes inserted in the soil at three sites in northern Utah. The 0C. isotherm varied in depth from the surface to 21 inches at lower elevation sites in Logan and to 41 inches on an exposed mountain ridge at 8,870 feet elevation. Steel tubing (1.55-inch inside diameter), commonly used as access tubes for neutron probes used in soil-water measurements, proved to be as good as steel or plastic pipe as casings for water-filled frost meter tubes. (De Byle, Forest Service)
W71-04251

HALF-MINUTE COUNTS FOR NEUTRON PROBES,
Forest Service (USDA), Fayetteville, Ark. Southern Forest Experiment Station.
T. L. Rogerson.
Soil Science, Vol 110, No 5, p 359-360, November 1970.

Descriptors: *Nuclear moisture meters, Performance, Evaluation.
Identifiers: Am Be source.

Counting intervals of one minute have been widely used to determine soil water content with neutron probe systems. Half-minute counting intervals have been found to be as precise as minute intervals for all practical purposes when using late model systems with 100 mc. Am Be sources. (Rogerson-Forest Service)
W71-04259

7C. Evaluation, Processing and Publication

ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02A.
W71-03869

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W71-03935

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
Geological Survey, Salt Lake City, Utah.
R. J. Madison.
Utah Basic-Data Release No 20, 1970. 33 p, 4 fig, 4 tab, 4 ref.

Descriptors: *Water quality, *Reservoirs, *Utah, *Wyoming, *Chemical analysis, Water analysis, Water properties, Depth, Vertical migration, Seasonal, Streams, Streamflow, Discharge measurement, Statistical methods, Correlation analysis, Data collections, Hydrologic data.
Identifiers: *Flaming Gorge Reservoir (Utah and Wyo.), Chemical Concentration relationships, Weighted-Average Concentrations.

This is a basic-data report of water quality in Flaming Gorge Reservoir in Utah and Wyoming. The construction of Flaming Gorge Dam began in 1957, and the reservoir began storing water in November 1962. This report tabulates the chemical-quality data which were collected during the study (1966-68) and summarizes some of the data available prior to closure of the reservoir. Three sets of data were collected from the reservoir during the study. The sampling locations and the data are shown. At each of the 13 collection sites in the reservoir, samples were collected at various depths from the surface to the bottom. Samples for complete chemical analysis were collected from 6 sites at both the beginning (October 1966) and the end (September 1968) of the data-collection phase of the study. The variation in dissolved ions with depth for these two sets of data are summarized. Samples for partial analysis were collected from 9 sites in September 1967, and the partial analyses are tabulated. Chemical-quality and water-discharge data were also collected from 19 sites on the minor tributaries to the reservoir during the summer and fall of 1967. These data are listed in 2 tablex and are summarized in graphs. Summary graphs of the mean annual weighted-average concentrations of selected constituents for the period 1957-67 are included. (Woodard-USGS)
W71-03936

COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 02J.
W71-03947

MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 02E.
W71-03960

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03977

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
Dum Dum Airport, Calcutta (India); and Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03978

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
Electricite de France, Chatou. Centre de Recherches et d'Essais.
For primary bibliographic entry see Field 02E.
W71-03979

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
Research Inst. for Water Resources Development, Budapest (Hungary); and Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02E.
W71-03981

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
National Office of Irrigation, Rabat (Morocco).
For primary bibliographic entry see Field 02E.
W71-03985

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
Consejo Superior di Investigaciones Cientificas, Madrid (Spain). Instituto de Hidrologia.
For primary bibliographic entry see Field 02E.
W71-03990

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 08B.
W71-04007

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04048

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02F.
W71-04057

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 04A.
W71-04111

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.

Geological Survey Water Data Catalog, 1970. 443 p, 2 fig, 2 exhibits, 4 tab.

Descriptors: *Data collections, *Hydrologic data, *Water quality, *Documentation, *Data storage and retrieval, Networks, Monitoring, Sampling, Maps, Instrumentation, Stations, Libraries, Investigations.
Identifiers: *Catalog of Information on Water Data.

An index is presented for use in retrieving water quality data from the Catalog of Information on Water Data, a record of activities in water data collection in the U.S. The Catalog is a file of information that is accessible through data-retrieval procedures--it contains information about water-data acquisition activities but does not contain the actual data, which must be obtained from the reporting agencies. Input to the Catalog consists of information supplied by Federal, State, and local agencies that acquire water data directly in the field and laboratory. All information is stored on media suitable for data processing, supplemented

by microforms and maps. Information from the Catalog (output) is made available through indexes such as this publication, which is the index to the water quality section of the Catalog. This index reflects activities as of January 1, 1970, and is the fourth edition of the 'Water Quality Index', the first of which was the 1966 edition. Included in this index are (1) identification and location of stations, (2) major types of data collected, (3) frequency of data collection, (4) in what form the data are stored, and (5) agencies reporting the activities. (Woodard-USGS)
W71-04150

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.

Geological Survey Water Data Catalog, 1970. 677 p, 2 fig, 2 exhibits, 4 tab.

Descriptors: *Data collections, *Hydrologic data, *Surface waters, *Gaging stations, *Data storage and retrieval, Documentation, Networks, Streamflow, Discharge measurement, Stream gages, Flow measurement, Watersheds (Basins), Monitoring, Maps, Instrumentation, Libraries, Investigations.
Identifiers: *Catalog of Information on Water Data, Station drainage area.

An index is presented for use in retrieving water quality data from the Catalog of Information on Water Data, a record of activities in water data collection in the U.S. The Catalog is a file of information that is accessible through data-retrieval procedures--it contains information about water data acquisition activities but does not contain the actual data, which must be obtained from the reporting agencies. Input to the Catalog consists of information supplied by Federal, State, and local agencies that acquire water data directly in the field and laboratory. All information is stored on media suitable for data processing, supplemented by microforms and maps. Information from the Catalog (output) is made available through indexes such as this publication which is the index to the surface water section of the Catalog. This index reflects activities as of January 1, 1970, and is the fourth edition of the 'Surface Water Index,' the first of which was the 1966 edition. Included in the index are (1) identification and location of stations, (2) major types of data collected, (3) frequency of data collection, (4) in what form the data are stored, and (5) agencies storing the data. (Woodard-USGS)
W71-04151

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Moscow (USSR).
For primary bibliographic entry see Field 02E.
W71-04176

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W71-04177

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.
W71-04184

FWPCA METHOD STUDY 1: MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04200

A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
Cornelius I. Weber.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. June 1966. 101 p, 164 fig.

Descriptors: *Diatoms, *Bioindicators, *Plankton, Colorado River, Columbia River, Delaware River, Hudson River, Mississippi River, Missouri River, Ohio River, Rio Grande, St. Lawrence River, Tennessee River, Great Lakes.
Identifiers: Sorting, Identification, Animas River, Apalachicola River, Arkansas River, Illinois River, Kanawha River, Klamath River, Little Miami River, Potomac River, Red River, Savannah River, Schuylkill River, Snake River, Yellowstone River.

A total of 164 diatom species are described and illustrated, representing 43 of the common genera found at FWPCA Water Pollution Surveillance System stations. Some of the species were selected primarily to demonstrate the morphological diversity within the genera. The geographical distribution of 96 of the species is shown in an accompanying chart. This guide was prepared to serve as a bench reference for biologists in the laboratory who are being trained in diatom identification. The guide also contains a glossary and generic key. The key was constructed with the beginner in mind, and is based entirely on the shape and markings of the diatom cell wall as observed in material mounted in Hyrax. No attempt was made to place the taxa in their proper phylogenetic order. (McCann-Battelle)
W71-04210

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
Iowa Univ., Iowa City. Inst. of Urban and Rural Research; Iowa Univ., Iowa City. Dept. of Geography; and Northern Illinois Univ., De Kalb. Dept. of Geography.
For primary bibliographic entry see Field 06B.
W71-04234

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
Middlebury Coll., Vt. Dept. of Geography.
For primary bibliographic entry see Field 02B.
W71-04235

VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle, and Harold F. Haupt.
Journal of Soil and Water Conservation Vol 24, No 5, p 196-197, September-October 1969.

Descriptors: *Rain gages, *Precipitation gages, *Precipitation intensity, *Rainfall intensity, *Precipitation (Atmospheric), Gages, Instrumentation, Measurement, Utah.

Accurate precipitation records can be obtained from a weighing-type recording precipitation gage if the amount of liquid in the bucket is measured with a graduated cylinder to verify the final reading on the chart. For an 8-inch-diameter orifice gage, the catch in milliliters is multiplied by 0.001214 to convert it to inches precipitation. (DeByle-Forest Service)
W71-04264

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
Economic Research Service, Washington, D.C. Natural Resource Economics Div.; and Oklahoma State Univ. Stillwater. Dept. of Agricultural Economics.
Ronald D. Lacewell, and Vernon R. Eidman.
Oklahoma State University Agricultural Research, Oklahoma Current Farm Economics, December 1969, Vol 42, No 4, p 5-11. 1 tab, 6 ref.

Descriptors: *Evaluation, *Computer models, *Computer programs, *Flood protection, *Water conservation, Resource allocation, Benefits, Flood routing, Productivity, Land use, Flood plains, Planning, Estimating, Flood damage, Water management (Applied), Net income, Oklahoma, Damages, Data collections, Return (Monetary).
Identifiers: *Nuyaka Creek flood plain (Oklahoma), Inundation depth, Flood ranges, Occurrence probability.

A computer program for estimating flood damage incidence was developed to assist flood protection planning agencies and flood plain farmers. The model estimates damages for land use, productivity, inundation depth and location. Larger area damages are summations of these individual categories. The model computes damages by grids of sample sites and assigned possible flood ranges. Average annual damages are estimated by weighting damages for each storm by its occurrence probability. The model was tested by application to Nuyaka Creek flood plain, east-central Oklahoma. Care must be exercised in the method of measuring benefits to flood protection and land use adjustments. Flood protection benefits are the difference between net returns for present land use and no protection ($11,700), and net returns for optimum land use with protection ($107,200). The difference between net returns with and without flood protection for present land use ($6,700) is an estimate of minimum expected flood protection benefits. A table shows present and optimum flood plain land use pattern and associated dollar values with and without flood protection at Nuyaka Creek. (Popkin-Arizona)
W71-04293

08. ENGINEERING WORKS

8A. Structures

WATER, A PROGRESS REPORT.
California State Dept. of Water Resources, Sacramento.

Department of Water Resources, Bulletin No 151-67, September 1968. 32 p, 28 fig.

Descriptors: *Water transfer, *Aqueducts, *Water supply, *Water resources development, *Water conveyance, *Construction, Powerplants, Pumping plants, Hydrologic data, Seismic studies, Earthquake engineering, Multiple-purpose reservoirs, *California.

Progress is summarized in the construction of the State Water Project, the world's largest single water development project. It is designed to conserve and deliver 4.23 million acre-feet of water annually to meet demands throughout much of California until 1990. Much of the project planning is being implemented by local agencies. Capital costs are estimated to exceed $2.8 billion. Project customers will repay about 90 percent of the total capital costs. The federal government will pay 3 percent, and the state the remaining 7 percent. California customers will buy water from the State Water Project and will contract for the use of the proposed San Joaquin Master Drain to remove excessively saline agricultural wastes from the endangered lands of the San Joaquin Valley. Water will be supplied from lakes formed by five dams on the Feather River and its tributaries northeast of San Francisco. The regulated release of water from Lake Oroville will flow down the Feather and

Sacramento Rivers and into the Sacramento-San Joaquin Delta. A part of the flow will enter San Francisco Bay and the balance will be conducted by a Peripheral Canal and aqueducts to supply water to south bay areas, and community and agricultural users along the Central Valley, and as far south as Riverside. Power generation is also a feature of the Project. Descriptions are given of hydrologic and geologic data collection activities, and snow runoff and earthquake prediction. Design considerations and recreational facilities are described. Design features and operational methods are highlighted and construction progress is summarized. Completion is scheduled for 1972. (Poertner)
W71-03905

1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
Los Angeles Bureau of Engineering, Calif.

Office Standard No 71, 1966. 51 p, 23 fig, 8 tab.

Descriptors: *Drainage engineering, *Drainage practices, *Storm drains, *Storm runoff, *Design standards, Hydrology, Hydraulics, Urbanization, Rainfall-runoff relationships, Runoff forecasting, Surface runoff, Drainage systems, Conduits, California.
Identifiers: *Storm sewers, *Urban drainage, Los Angeles (Calif).

The publication is an assembly of tables, curves, and instructions for computation of urban storm runoff and for designing urban stormwater drains under various conditions of topography, imperviousness, soil types, slopes and precipitation intensities. The material was first printed in 1939 to serve as an office standard in the Storm Drain Design Division of the Bureau of Engineering. This printing contains revisions to previous printings and adds several new parts including: a section titled 'Hydrology of Steep Hillside or Mountainous Areas in Natural State', a formula for computing the adjusted time of concentration at junctions of a main-line storm drain with its laterals, and other charts and tables. The design instructions for computing runoff are based upon theories and methods outlined in two papers: (1) 'A Method of Computing Urban Runoff,' by W. I. Hicks (Transactions, American Society of Civil Engineers, Vol. 109, March 1945); and (2) 'Surface Runoff Determinations from Rainfall without Using Coefficients,' by W. W. Horner and S. W. Jens (Transactions, ASCE, Vol. 107 (1942), page 1039). Detailed instructions are given for applying the 'peak rate' method and the method of 'summing hydrographs' for computing runoff. Reduction factors to account for conduit detention in computing peak runoff flows are given. (Poertner)
W71-03906

STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
Bureau of Reclamation, Denver, Colo.
N. A. Andryanova.
Translation of: Gidrotekhnicheskoe Stroitel'stvo, No 10, p 25-28, 1965. Available from NTIS as PB-193 647, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 625, Aug 1966. 15 p, 6 fig, 3 ref.
Identifiers: *Dams, Stresses, Rock (Geology), Pressure, Mathematical analysis, Foundations (Structures), USSR, Translations, Rockfill dams.

The basic propositions are presented of the method of Professor Ode * (Wasserwisischaft u. Wassertechnik, Vol 3, No 7:248-252, 1953) for the computation of the stresses within the body of a homogeneous earthen dam, however with the difference that the transverse pressure coefficient of the soil is determined not by the trial and error method as in the case of Ode, but on the basis of the theory of soil pressure on a rigid wall with account for the computation coefficient following Prokof'yev. (Author)
W71-04003

MOLE DRAINAGE,
Arctic Construction and Frost Effects Lab., Boston, Mass.
Howard M. Williams, and James F. Haley.
Available from NTIS as AD-712 582, $3.00 in paper copy, $0.95 in microfiche. Technical Report No ACFEL-TR-38, Sept 1951. 36 p.
Identifiers: *Landing fields, Drainage, *Drainage, Structures, Soils, Plasticity, Earthhandling equipment, Pipes, Concrete, Mixtures, Asphalt, Cements, Grout, Sand, Stability, Pumps, Structural properties, Pavements, *Mole drainage, Portland cements.

A mole drainage system has proved very effective in reclaiming many areas of low-lying poorly drained agricultural lands and should prove a valuable tool in the construction of airfields under similar conditions. It is believed that even in soils containing some sand or silt, the mole drains would greatly increase drainage for short periods of time with resultant construction benefits. It is recognized that the mole drains would greatly increase drainage for short periods of time with resultant construction benefits. It was recognized that the mole drain's usefulness was severely limited unless some simple but effective method of making the drain a relatively stable structure in a wide variety of soil conditions could be achieved. It was to study this problem that a series of laboratory investigations and model tests were initiated in the Soils Laboratory of the New England Division, Corps of Engineers, in Boston in 1946. The investigations to date have followed two general paths of study: First, to attempt to strengthen the existing soil walls of the mole drain by a coating or liner cast in place during the passage of the mole plow and, second, to insert a suitable prefabricated liner into the mole drain behind the plow.
W71-04008

PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08F.
W71-04015

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
For primary bibliographic entry see Field 06E.
W71-04094

8B. Hydraulics

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
For primary bibliographic entry see Field 02E.
W71-03968

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-03995

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03999

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

Available from NTIS as PB-195 275, $3.00 in paper copy, $0.95 in microfiche. Edited by J. C. Schuster. Bureau of Reclamation Report REC-OCE-70-38, September 1970. 49 p, 52 fig, 37 ref.

Descriptors: *Hydraulics, *Hydraulic structures, *Irrigation, Parshall flumes, *Discharge measurement, *Water measurement, Closed conduit flow, Discharge coefficients, Weirs, Orifices, Current meters, Bibliographies, Irrigation operation and maintenance, Venturi meters, Radioisotopes, Field investigations, Flowmeters, Instrumentation.
Identifiers: Irrigation Operators' Workshop, Dilution method, Magnetic flow meters, Ultrasonic flow measurement, Constant-head-orifice T O.

Water Measurement Procedures were written primarily for use in the Irrigation Operators' Workshop classes as a teaching aid in presenting the fundamentals of water measurement to field personnel engaged in irrigation work. Technical material has been simplified to provide a clear understanding of water measurement devices and procedures. Basic hydraulics presented include the discharge equation, velocity head concept, orifice and weir relationships, and the effect of submergence. Factors affecting the accuracy of measurement such as work equipment, infrequent head measurement, and use of wrong measuring devices are analyzed. Commonly used devices and methods are discussed, including orifices, weirs, Venturi meters, Parshall and Venturi flumes, meter gates, constant head turnouts, and propeller meters; special devices and methods include vane deflection meters, acoustic and magnetic meters, and the dilution and radioisotope methods of measurement. Hints for troubleshooting poorly operating devices, suggestions to operators on how to do a good job, and a selected reading list for operators are given. This edition supersedes the previous editions numbered Hyd 552, 565, and 577.
W71-04007

CHAIN MODEL OF RIVER MEANDERS,
Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
For primary bibliographic entry see Field 02E.
W71-04124

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 07B.
W71-04127

THE TRAPEZOIDAL FREE OVERFALL,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and D. Muralidhar.
Text also in French. Journal of Hydraulic Resarch, Vol 8, No 4, p 419-447, 1970. 29 p, 12 fig, 2 tab, 18 ref.

Descriptors: *Stage-discharge relations, *Open channel flow, *Overfalls, Open channels, Hydraulics, Discharge measurement, Stream gages, Flumes, Canals.
Identifiers: *Overfalls (Trapezoidal).

A theoretical and experimental study of trapezoidal free overfall predicts the end depth ratio for horizontal and sloping channels. The pressure coefficient at the end section was obtained from direct pressure measurements and it lies between the values for rectangular and triangular overfalls. Two charts were constructed to facilitate the prediction of discharge when the end depth is known. Supplementary information regarding the flow profile, velocity field and the bed shear stress are presented. (Knapp-USGS)
W71-04128

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
N. S. Lakshmana Rao, and G. Purushotham.
Journal of Hydraulic Research, Vol 8, No 4, p 449-455, 1970. 7 p, 8 fig, 1 tab, 1 ref.

Descriptors: *Calibrations, *Weirs, *Discharge measurement, *Stream gages, *Stage-discharge relations, Discharge (Water), Surface waters, Streamflow.
Identifiers: *Weirs (Triangular section).

Because triangular weirs are more sensitive than rectangular weirs, especially at low flows, the rectangular base-weir of the Sutro weir can be advantageously replaced by a triangular bottom. None symmetrical and three asymmetrical linear proportional weirs with triangular bottoms were tested for different values of height and width. A nomogram was prepared for finding the discharge coefficient. (Knapp-USGS)
W71-04129

8C. Hydraulic Machinery

DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
Bureau of Reclamation, Denver, Colo.
L. L. Smelkov.
Translated from: Energomashinostroenie No 1, p 21-22, 1966. Available from NTIS as PB-193 634T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 714, March 1967. 8 p, 1 fig, 4 ref.

Descriptors: *Critical speed, Hydraulic turbines, Differential equations, Hydraulic machinery, Generators, *Vibrations, Torsion, Fluid flow, Design tools, *Shafts, Machinery, Electromagnetism, Foreign design practices, Mathematical analysis, Deflection, Natural frequency, Cantilevers, Stress, Moments of inertia, *Rotating components, Structural analysis.
Identifiers: USSR, Rotors, Machine design, Stators, Gyroscopic effects.

Effect of quasi-elastic forces of electromechanical origin on the primary critical speed of a shaft in calculating natural frequencies of torsional and transverse vibrations is shown. New methods introduced by USSR hydroturbine manufacturers for calculating shaft stability should consider the generator not only as a concentrated mass but also for the electromagnetic field it creates. This leads to new phenomena, especially in determining critical speeds for transverse vibrations. An equivalent mechanical system with parameters depending on characteristics of generator windings and operating conditions can be substituted for the electromagnetic field in determining natural frequencies of torsional vibrations. Solving the differential equations shows that electromechanical vibration frequency is from 0.5-2.5 cps, indicating that calculation of these values is obligatory to construct a full frequency spectrum. For transverse vibrations, a 1-sided electromagnetic pull between the rotor and stator and forces of inertia on the deflection of the shaft must be considered. The author concludes that calculating the electromagnetic field for torsional vibrations gives a smaller value for natural vibration frequency and for transverse vibrations leads to a lowering of the primary critical speed. Sample calculations for a specific shaft are given.
W71-03996

EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
Bureau of Reclamation, Denver, Colo.
L. P. Gryanko, and V. G. Staritskii.
Translated from: Trudy Leningradskogo polytekhnicheskogo instituta No 297, p 63-67, 1968. Available from NTIS as PB-193 643T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 579, Aug 1969. 12 p, 6 fig, 5 ref.

Descriptors: *Hydraulic machinery, *Hydraulic turbines, Foreign design practices, Model tests, *Turbine runners, Laboratory tests, Efficiencies, Cavitation, Research and development, Mechanical engineering, Hydraulics, Surges, Turbulent flow, Testing machines, Discharge measurement, Hydraulic design, Foreign research.
Identifiers: USSR, Leningrad Polytechnic Inst, Krasnoiarsk Powerplant, *Machine design, Comparative studies.

The Hydraulic Machinery Laboratory at Leningrad Polytechnic Institute has developed a combined Francis and propeller runner to fit the operating conditions and dimensions of Krasnoiarsk Hydropowerplant. Models of 2 alternative designs of this runner were tested and the data compared with that of Runner RO-697, the Francis runner used at Krasnoiarsk. The only dimensional design change is that the flare angle of the lower band is 13 deg instead of the 20 deg of RO-697. The model tests and data analysis led to these conclusions: (1) Since specific speed and discharge capacity of the combined runner are significantly higher than for RO-697, using this runner at Krasnoiarsk would increase unit capacity at the generator to 580 mw and reduce the total number of units by one. (2) Energy factors for the improved model design showed that efficiency was only 0.5 or 1% less than that of RO-697. (3) Cavitational qualities were about equal. (4) Pressure surges beyond the new runner were 30-40% lower than beyond RO-697, reducing turbulence in design operating conditions and also during startup at reduced heads. The combined runner's greater discharge capacity will increase its operational reliability over that of RO-697.
W71-03998

SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
Bureau of Reclamation, Denver, Colo.
L. I. Kudoyarov, and N. P. Borodin.
Translated from: Gidrotekhnicheskoe Stroitel'stvo No 4, p 4-10, 1966. Available from NTIS as PB-193 629T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 703, Aug 1967. 24 p, 6 fig.

Descriptors: Hydroelectric powerplants, Kaplan turbines, Foreign projects, Precast concrete, Reinforced concrete, Reinforcing, *Forms, Concrete, *Concrete technology, Concrete structures, Concrete plants, Aggregates, Erection, Earth handling equipment, Excavation, Foundations, Joints, Dams, Aprons, Earth dams, Dikes, *Hydraulic fills, Multiple purpose structures, Locks, Slope protection, Fish handling facilities, Construction, Hoisting machinery, Manufacturing.
Identifiers: USSR, Hydromechanization, Saratov Powerplant (USSR), Volga Cascade System (USSR), Run-of-the-river powerplant.

Saratov hydrocomplex, the seventh step of the Volga cascade to be constructed in the USSR, is unique among low-head, run-of-the-river powerplants, because it is largely constructed of huge precast, reinforced concrete elements made monolithic by careful grouting of the joints and overlap welding of protruding reinforcement rods. Among the basic features described are: the common structure containing 21 vertical and 2 horizontal units for passing surplus river discharges and generating power; fish-handling facilities; two-level railroad and highway bridge; and the double single-stage dry-dock-type ship locks. Interesting features include the 3-level powerhouse arrangement with turbine bypass spillways equipped with louvered fish inlets; the earthfill dam and dikes with interlocking concrete slab slope protection; and the upstream apron constructed of 10-m-thick hydromechanized fill sandwiched between concrete slabs. The production line for precast reinforced concrete elements weighing up to 200 tons each and erection methods developed to handle such loads are described. This includes the crane-operated tilter for uprighting slabs manufactured in a horizontal position. Production methods for forming, automatic welding of reinforcement frames, pouring and vibrating, and steam-curing are given.
W71-04017

8D. Soil Mechanics

DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 02G.
W71-04006

DRAINAGE LINE DEPTH,
Bureau of Reclamation, Denver, Colo.
I. M. Krivonosov.
Translated from: Gidrotekhnika i Melioratsiya Vo 18, No 6, p 44-51, 1966. Available from NTIS a PB-193 617T, $3.00 in paper copy, $0.95 i microfiche. Bureau of Reclamation Translation N 685, Oct 1967. 11 p, 5 fig, 1 tab, 11 ref.
Identifiers: *Soils, Drainage, Permeability, Clay Sand, Penetration, Cracks, Water, Fluid flow Freezing, Melting, Reclamation, Terrain, USSR Translations, Land reclamation.

The principal factors determining the selection o drainage line depth are: the filtering capacity of the soils, the depth to which the soil freezes and the course of its thawing, the purpose for which the land is being reclaimed, and the critical calculated period for removal of ground waters. Under similar soil conditions but with different freezing depth the rational solutions of this problem may differ. For water-permeable noncoherent soil conditions the relationship between the depth of the drains and the distance between them is sufficiently well established, and among the specialists no differences of opinion exist on the problem of the optimum drain depth. However, there are different opinions on the depth at which a drain should be placed in clayey soils and ground. The question of the necessary depth for drains in clayey loam and clayey soil-ground is examined.
W71-04016

8E. Rock Mechanics and Geology

STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08A.
W71-04003

8F. Concrete

HOT-THERMOS METHOD OF CONCRETING,
Bureau of Reclamation, Denver, Colo.
Ya Besser.
Translated from: Stroitel' No 10, p 11-12, 1968. Available from NTIS as PB-193 640T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 533, March 1969. 6 p.
Identifiers: *Concrete, Processing, Heating elements, Experimental design, Electrical equipment, Safety, Sodium chloride, USSR, Translations.

A new method is described of winter concreting of monolithic structures, called the 'Hot Thermos Method', in which the concrete mix, prepared from cold ingredients, is delivered to the concreting site and electrically heated just before placement in the forms.
W71-03997

CONCRETE FOR KRANSNOLARSK DAM,
Bureau of Reclamation, Denver, Colo.

G. Ginzburg, N. A. Zinchenko, and G. F.
ortsova.
nslated from: Gidrotekhnicheskoe Stroitel'stvo
2, p 6-12, 1966. Available from NTIS as PB-193
T, $3.00 in paper copy, $0.95 in microfiche.
eau of Reclamation Translation No 676, Oct
6. 31 p, 10 fig, 1 tab.

criptors: *Mass concrete, Concrete technology,
ching, *Concrete control, *Concrete mixes,
crete placing, *Concrete plants, Concrete
ctures, *Concrete dams, Dosage, Measure-
t, Aggregates, Gradation, Field permeability
, Conveyors, Automatic, Frost action, Quality
trol, Design standards, Portland cement, Slags,
ign projects, Slump, Water cement ratio,
hanization, Sands, Permeability, Cooling,
ting, Concrete testing, Cold weather opera-
s.
tifiers: USSR, Frost resistance, Krasnoiarsk
(USSR), Crack control.

lity control field testing of aggregate, cement,
concrete at Krasnoiarsk Dam, USSR, showed,
f Sept 1964, that: (1) washed sands and gravel
specifications, except for larger fractions
re a second sorting at the concrete plant was
mmended; (2) cement was very satisfactory as
ineral composition, heat outflow, and strength;
both concrete control specimens and cores
ed from the mass concrete of the dam columns
within specification limits for strength and
r impermeability; and (4) temperature control
oncrete at placement was still not acceptable
ummertime. However, in the 2 yrs since the
mass concrete placement (8-61), many
lems had to be faced and many changes made
ocedures, equipment, and organization in the
gate processing plants, the Krasnoiarsk Ce-
t Plant, and the 2 mixing plants to achieve the
ed results. A fully automated continuous-flow
rete mix plant for both portland cement and
portland cement concretes and a 3-section
ing plant for special types or batches of
rete are in use. The article discusses problems
e automated equipment, temperature control,
ly, and construction site organization that had
resolved. The figures show layout for continu-
low mix plant, zoning of dam for types of
retes, cement chemical composition, and test
ts.
-04004

CAST REINFORCED CONCRETE IN RAULIC CONSTRUCTION,
au of Reclamation, Denver, Colo.
Zavalishin, and Yu. E. Chumichev.
slated from: Gidrotekhnicheskoe Stroitel'stvo
, p 1-4, 1966. Available from NTIS as PB-193
, $3.00 in paper copy, $0.95 in microfiche.
au of Reclamation Translation No 702, Feb
. 20 p, 11 ref.

riptors: *Precast concrete, *Concrete
ology, Foreign design practices, Foreign con-
tion, Construction costs, Concrete structures,
, Joint fillers, Hydraulic structures, Concrete
, Cast-in-place structures, Foundations, Gir-
Floors, Panels, Piers, Erection, Reinforcing,
orced concrete, Slabs, Hydroelectric power-
, *Construction joints, Hoisting machinery,
lation, Industrial plants, Transportation.
ifiers: USSR, Kiev Powerplant (USSR),
st concrete components, Innovation, Con-
ion equipment, Evaluation, Saratov Power-
(USSR).

USSR is evaluating the technical effectiveness
conomy of using precast reinforced concrete
ural components to erect large hydraulic
ures, such as the experimental powerplants of
on the Dneiper and Saratov on the Volga. The
ry conclusion drawn was that the use of this
od must be evaluated separately for each pro-
n relation to local conditions and design
ia. To effect actual economics, designers can
ardize the recurring components of separate
of powerplants, such as enclosures for spiral
and draft tubes; embedded structural slots,
keys, drains, etc.; inspection and drainage galleries; and reinforced panels for run-of-the-river powerplants with not over 50 m of head. Only for run-of-the-river plants with heads less than 20 m can the exclusive use of these components in a structure be justified technically and economically. Manufacturing costs can be reduced to 40-45 rubles cu m to effect in-place costs of 50-60 r/cu m. Ideal use is building a series of 20 such plants in sequence of 2-3 at a time, served by the same mobile production-line manufacturing plant and construction equipment. Forming joints between the components, a major problem, has now been satisfactorily resolved.
W71-04015

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ANNUAL REPORT, JULY 1, 1969-JUNE 30, 1970,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Available from NTIS as PB-197 120, $3.00 in paper copy, $0.95 in microfiche. Report UNC-WRRI-71-00, (1970). 49 p. 7 tab, 19 fig. OWRR Program A-999-NC (21).

Descriptors: Education, Colleges, Universities, Training, North Carolina, Allotments, Projects, Grants, Contracts, Programs, Research and Development.

The Institute's research program for fiscal year 1969-70 was supported by the annual allotment and seven matching grants from the Office of Water Resources Research, U.S. Department of the Interior, non-federal matching and other funds from the State of North Carolina and private industry, and one grant from the Z. Smith Reynolds Foundation. The total value of the program in 1970 exceeded one-half million dollars--a five-fold increase since the first full year in 1966. This included twenty-three research projects and other activities involving thirty-two man-years of graduate students, faculty and staff. This report contains description of water resource problems and related research projects, summary of research findings, and discussion of program development, education, and public service programs.
W71-03921

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
Federal Council for Science and Technology, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04105

9D. Grants, Contracts, and Research Act Allotments

ANNUAL REPORT, JULY 1, 1969-JUNE 30, 1970,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W71-03921

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS: 1966 STATISTICAL SUPPLEMENT.
Bureau of Reclamation, Denver, Colo.

1968. 579 P, 2 INDEXES, 471 TAB.

Descriptors: *Federal reclamation law, *Statistics, *Allotments, *Data collections, Financing, Administrative agencies, Administration, Government finance, Grants, Legislation, Cost allocation, Loans, Reclamation, Missouri River Basin, Federal budgets, Federal government, United States, Federal jurisdiction, Assessments, Legal aspects, Water resources development, Economics, Loans.

Generally, this statistical supplement provides detailed information relating to the funding of those various water resource projects over which the Bureau of Reclamation has some degree of responsibility. Presented is a tabulation of appropriation acts and allotments to 471 Bureau of Reclamation projects and activities. Chapter one and two deal with those public and private appropriation acts passed for the Bureau of Reclamation by the 87th through the 90th Congresses. The balance of the report contains statistical tables regarding appropriations and allotments in fiscal years 1903 through 1966. The report excludes funding activity relating to: (1) appropriation transfers to other governmental agencies or projects, and (2) unused appropriations. Chapter four contains detailed tables regarding 176 specific projects or activities funded through the Bureau of Reclamation. Allotments made to 145 activities and projects within the Missouri River Basin are listed in Chapter five. Chapter six presents statistics on Bureau of Reclamation loan programs. Project allocations from emergency relief appropriations are set forth in Chapter seven, and water conservation and utility project allotments are presented in Chapter eight. (Earl-Florida)
W71-04103

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
Federal Council for Science and Technology, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04105

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
Bureau of Reclamation, Washington, D.C.

U. S. Government Printing Office, Washington, D.C. 1001 p.

Descriptors: *Allotments, *Land reclamation, *Federal Reclamation Law, *Legislation, Federal government, Statistics, Reclamation, Administrative decisions, Budgeting, Financing, Capital, Capital supply, Legal aspects, Reclamation states, Flood control, Construction costs, Soil conservation, River basin development, Levees, Dam construction, Hydroelectric plants, Water utilization.

A chronoloigcal compilation of allotments and appropriations for the Bureau of Reclamation during the period 1903-1960, this publication lists: (1) allotments authorized by the Secretary of the Interior, (2) appropriation acts of Congress, (3) private laws dealing with reclamation, (4) contingency funds allotted, (5) flood control appropriations made to the War Department, (6) soil and moisture conservation allotments, (7) emergency relief appropriations, (8) civiliam public service camp and conservation corps allotments, and (9) interagency transfers of appropriations. Within the text of the various appropriations and allotments, frequent mention is made of specific levee systems, river development, river-basin development, hydroelectric power projects, dam projects, and other water-related projects within the purview of the Bureau of Reclamation. A listing of water-conservation-and-utilization project funds transferred to other governmental agencies is also presented. (Earl-Florida)
W71-04309

10. SCIENTIFIC AND TECHNICAL INFORMATION

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION

CONTROL, ADMINISTRATION: SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W71-03879

WATER RESOURCES SYSTEMS ENGINEERING,
California Univ., Riverside. Dept. of Engineering; and California Univ., Los Angeles. Dept. of Engineering.
For primary bibliographic entry see Field 06A.
W71-03885

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
Powell (Sheppard T.) and Associates, Baltimore, Md.
For primary bibliographic entry see Field 03A.
W71-03916

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-04000

GLOSSARY OF TERMS USED IN WELL LOGGING,
Chevron Oil Co., Houston, Tex.
Robert E. Sheriff.
Geophysics, Vol 35, No 6, p 1116-1139, December 1970. 24 p, 15 fig.

Descriptors: *Publications, *Logging (Recording), *Wells, Documentation, Technical writing, Electrical well logging, Radioactive well logging, Borehole geophysics, Seismic studies.
Identifiers: *Well logging terms (Glossary).

This glossary of terms used in well loggin presented as a semifinal draft of a part of a la glossary of terms used in geophysical explorat (Knapp-USGS)
W71-04113

REVERSE OSMOSIS DESALTING STATE-THE-ART (1969).
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 03A.
W71-04225

ABSTRACTS OF LITERATURE ON T DISTILLATION OF SEAWATER AND ON T USE OF NUCLEAR ENERGY FOR DESALTI
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
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- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.

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- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
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VOLUME 4, NUMBER 9
MAY 1, 1971

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W71-04351 -- W71-04850

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 9
MAY 1, 1971

W71-04351 -- W71-04850

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency, Water Quality Office. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

WATER CYCLE

General

OPIC HYDROLOGICAL STUDIES OF THE THWEST SAHARA (FRENCH),
re de Recherches sur les Zones Arides, Paris ce); and Paris Univ. (France). Faculte des ces.
nrad, and J. Ch. Fontes.
topе Hydrology, 1970, Proceedings Symposi- f International Atomic Energy Agency and SCO, Vienna, March 9-13, 1970: Vienna, In- ional Atomic Energy Agency STI/PUB/255, No SM-129/24, p 405-419, 1970. 15 p, 5 fig, 16 ref.

iptors: *Surface-groundwater relationships, le isotopes, *Deserts, *Water balance, itation (Atmospheric), Evaporation, rge, Discharge (Water), Deuterium, Oxygen, ers, Streamflow, Arid lands.
fiers: *Sahara, *Oxygen isotopes.

of the paleovalley of the Saoura Wadi in the vestern Sahara includes an examination of sotopic composition of the aquifer, the itation, and the surface system. The collec- f samples from every precipitation at Beni on the present middle course of the Saoura es a mean of determining the O-18 content heaviest rain storms which could feed the pirs, and of assessing the weighted mean c composition of this contribution. The in- e of evaporation on the river waters can be ted from the south side of the Sahara Atlas ains where the floods originate to the endor- asin of the Sebkha-al-Melah, where the water ates. On the middle course of the Wadi, the rough evaporation is partially compensated ontribution from aquifers whose existence ought to light by continuous comparative of the isotopic composition of the Wadi and the Great Western Erg waters. The egional reservoirs connected with the Saou- ey have also had their O-18 content deter- The Saoura paleovalley is also a line along a water body found at various depths hout the north Sahara discharges. Samplings aquifer, both in the Saoura valley and hout the western Sahara, can be used for a specific study of the western part of this ir. The data obtained are compared with s for the other reservoirs, the surface system sent precipitation. (Knapp-USGS)
4386

DISCHARGE AND TIME OF CONCEN- ON RELATION TO RAIN INTENSITY TIGATED BY PHYSICAL MODELS OF RSHEDS,
Agricultural Univ. (Czechoslovakia).
Nemec, and Miloslav Moudry.
ds and Their Computation, Vol 1, Interna- ssociation of Scientific Hydrology Publica- 84 (Unesco-WMO), p 510-518, 1969. 9 p, tab, 23 ref.

tors: *Rainfall-runoff relationships, *Model *Hydraulic models, *Simulated rainfall, matical models, Analog models, Hydraulic de, Hydrograph analysis, Synthetic hydrolo- discharge, Rainfall intensity, Time of con- on.
ers: Watershed models.

nt factors influencing the flood flow in small an be expressed as a function of the con- on or lag time. From the example of an ex- tal basin in Czechoslovakia, the relation- concentration time and peak discharges is trated. The recurrence interval of the peak ge and the rain intensity are also taken into ration. In order to investigate the influence rent factors on the concentration time, of rainfall-runoff process are considered. A model of a watershed is being developed. The process is simulated with the help of a rain simulator. Watershed models in different scales are used to investigate the development of similarity criteria. Theoretical approaches to the similarity problem are discussed and the approaches through dimensional analysis and differential equations of motion are described. Further investigations aiming to relate the prototype to the model are considered. (Knapp-USGS)
W71-04388

THE FLOOD FORECASTING BY A SERIES STORAGE TYPE MODEL,
National Research Center for Disaster Prevention, Tokyo (Japan).
M. Sugawara.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 555-560, 1969. 6 p, 10 fig.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Surface-groundwater relationships, *Flood forecasting, Water storage, Infiltration, Hydrograph analysis, Storm runoff, Computer models.
Identifiers: Series storage models.

The series storage rainfall-runoff model is a structure composed of storage models arranged vertically in series. The storage type model is based on the hypothesis that both discharge and infiltration are functions of the amount of water stored in the ground. In the case of low rainfall, water passes through the first structure at the top of the series model and it runs off from the second or third structure with a smoothed hydrograph and time lag. Heavy rain however results in water discharging from the first structure as a flood. The discharge from the second or third structure forms the gradual fall of the hydrograph after the flood. This model seems to be useful for runoff analysis in general, including floods. A digital computer program was written to calculate numerical solutions using the series storage model. (Knapp-USGS)
W71-04390

METEOROLOGICAL CAUSES OF RAINFALL FLOOD OCCURRENCES IN THE BASIN OF THE UPPER VISTULA,
State Inst. of Hydrology and Meteorology, Warsaw (Poland).
For primary bibliographic entry see Field 02B.
W71-04392

THE SIGNIFICANCE OF CHARACTERISTICS OF BASIN RAINFALL AND MORPHOMETRY IN A STUDY OF FLOODS IN THE UNITED KINGDOM,
Hydrological Research Unit, Wallingford (England).
J. C. Rodda.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 834-845, 1969. 12 p, 3 fig, 3 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Geomorphology, *Rainfall disposition, *Distribution patterns, *Frequency analysis, Peak discharge, Rainfall intensity, Rational formula, Routing, Streamflow forecasting, Flood forecasting, Statistical methods.
Identifiers: United Kingdom.

There are various ways of predicting floods on ungaged rivers. One method is to employ a formula relating peak discharges for basins where flows are measured to the characteristics of those basins. Such a formula was devised by multiple regression analysis, using records from 26 small basins in Britain. Magnitude-frequency relations were determined for the floods in each basin and the mean annual floods were related to characteristics of basin rainfall and morphometry. The rainfall term was obtained from a countrywide study of intense rain using daily maximum falls, while basin area and drainage density were employed as the other variables. Use of all these factors in the multiple regression analysis produced the most satisfactory formula for predicting the mean annual flood. However because of the errors it involved, which were due in part to variations in geology and surface conditions, it was suggested that future studies should be based on the regional analysis approach. (Knapp-USGS)
W71-04393

DETERMINATION OF STORM RUNOFF BY THE USE OF INFILTRATION INDEX,
Ministry of Railways, Lucknow (India).
A. Bhatnagar.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 804-810, 1969. 7 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Storm runoff, *Streamflow forecasting, Interception, Water storage, Infiltration, Antecedent precipitation, Rainfall, Duration curves, Discharge (Water), Hydrograph analysis, Depth-area-duration analysis.
Identifiers: India.

Storm runoff can be estimated quite accurately by an estimate of interception, retention and an infiltration index which includes other minor losses such as evaporation and transpiration. Hydrological data of 17 representative catchments in Central India were analyzed to estimate initial losses and infiltration indices occurring during storms. A coaxial relation between infiltration index, the antecedent precipitation index, storm rainfall and storm duration has also been evolved for the region. If storm duration, storm rainfall and antecedent precipitation conditions are known, the infiltration index during a storm on a catchment in this region can be determined. Storm runoff can then be estimated by subtracting initial loss and infiltration index from storm rainfall rates. (Knapp-USGS)
W71-04397

INTERRELATION OF RIVER WATER AND UNDERGROUND WATER DURING FLOOD PERIODS,
State Hydrological Inst., Leningrad (USSR); and Moscow State Univ. (USSR).
A. I. Chebotarev, O. V. Popov, and B. I. Koudelin.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 797-803, 1969. 7 p, 2 fig, 2 tab, 4 ref.

Descriptors: *Surface-groundwater relationships, *Bank storage, *Floods, *Base flow, Hydrogeology, Aquifers, Streamflow, Discharge (Water), Infiltration, Recharge, Water levels, Water level fluctuations, Hydrograph analysis.
Identifiers: USSR, Bank regulation.

Flood wave formation involves the interrelation of river and underground waters. Water exchange between river and river-side aquifers must be taken into consideration. In the USSR this phenomenon is generally referred to as bank regulation. It results in time redistribution of streamflow and underground river recharge, in decrease in maximum discharge, and increase in low water flow in the period between floods. The bank regulation effect is dependent on the hydrogeological structure of river valleys and on river regime. The principles of bank regulation in different hydrogeological conditions are outlined. Data characterizing the bank regulation effect under different physiographical conditions are given. (Knapp-USGS)
W71-04398

STATISTICAL CORRELATION OF HIMALAYAN AND BUNDELKHAND BASIN CHARACTERISTICS WITH FLOOD FLOWS,
Uttar Pradesh Irrigation Research Inst., Roorkee (India).

For primary bibliographic entry see Field 04A.
W71-04411

CONDITIONS LEADING TO THE FORMATION OF RAIN FLOOD FLOW ON SMALL RIVERS IN THE SOUTHERN PART OF THE FAR EAST,
Far Eastern Hydrometeorological Research Inst., Vladivostok (USSR).
I. N. Hartzman.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 932-940, 1969. 9 p, 2 fig, 3 ref.

Descriptors: *Rainfall-runoff relationships, *Flood routing, *Routing, Time lag, Hydrologic data, Peak discharge, Water storage, Base flow, Flood forecasting, Correlation analysis, Statistical methods.
Identifiers: USSR, Far East (USSR).

Rainfall regime of catchments were studied to make recommendations for computing the flood-forming precipitation for areas of simultaneous runoff and determining losses of rain water. Depletion of the effective basin water-storage was investigated using mass material for the conditions typical for the south of the Far East of the USSR (mountain forested catchments, plain catchments, partially marsh-ridden catchments and permafrost regions). Observations at experimental stations and in the overall network served as a basis for working out the recommendations for computing the time of travel of surface and channel flood flow in various conditions of the south of the Far East. When hydrological data were absent or insufficient, calculations of the crest and the total volume of hydrographs of rain floods for small rivers were made on the basis of the pluvial input and runoff into the channel network as well as for the flow duration of this water to the gaging section. A comparison between the computed and the observed characteristics of the flood flow shows that their agreement is sufficient for the method to be used as a basis for designing hydraulic structures. (Knapp-USGS)
W71-04414

TRANSFER FUNCTIONS FOR THE ANALYSIS OF RAINFALL-RUNOFF RELATIONS,
Technion-Israel Inst. of Tech., Haifa.
M. H. Diskin.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 962-971, 1969. 10 p, 3 fig, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical studies, *Hydrograph analysis, *Unit hydrographs, Depth-area-duration analysis, Flood forecasting, Streamflow forecasting.
Identifiers: Transfer functions.

Rainfall-runoff relations for watersheds are usually studied by means of the convolution integral. Considering the analogy between the watershed and a lumped input-output system, the three functions that appear in the integral are the output, the input, and the impulse response functions of the system. The convolution integral is strictly applicable only if the watershed system is linear; otherwise, it may be used only in an approximate way by assuming that the response functions varies from storm to storm but remains constant during any one storm. Non-linearity of watershed systems may be studied by changes in the form of the response functions. The process of deriving the shape of the response function from rainfall and runoff records is tedious and involves trial and error methods. It is possible however to study the properties of the response function from the properties of the transfer function which is defined as the Laplace transform of the response function. In contrast to the complexity of deriving response functions, the transfer function is obtained directly from transforms of the output and input functions. The properties of transfer functions for watershed systems are discussed, and methods are given for obtaining these functions and for their use for the analysis of rainfall-runoff relations. (Knapp-USGS)
W71-04416

CALCULATION AND ANALYSIS OF THE WATER BALANCE USING DATA ON PRECIPITATION AND RIVER DISCHARGE,
Institute for Geological and Geophysical Research, Belgrade (Yugoslavia).
J. Dzakovic.
Trans. From Vesnik Zavoda Za Geoloska i Geofizicka Istrazivanua, Ser B, No 8, p 123-129, 1968. Available from NTIS as TT 68-50062. Bulletin of Engineering Geology and Hydrogeology, Ser B, No 8, p 111-116, 1968. 6 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Water balance, *Hydrograph analysis, *Recession curves, Streamflow forecasting, Discharge (Water), Precipitation (Atmospheric), Water storage, Groundwater movement, Hydrogeology, Water level fluctuations.
Identifiers: Groundwater balance.

Water balance calculation for the catchment area of a river uses the method of resolving sources of the river hydrograph, supplemented by the recession method. Isolating the contribution made by groundwater to the total river discharge eliminates subjective estimation of this quantity and at the same time makes it possible to give a relatively accurate estimate of the change in groundwater reserves over the period of observation. Cumulative statistical analysis of the data gives information about the quantity of water stored on the surface, primarily in the form of snow and ice. This method of obtaining quantitative estimates of groundwater and surface water is convenient for application in regional hydrogeological investigations of little-studied catchment areas. (Knapp-USGS)
W71-04610

THE ENERGY BALANCE CLIMATOLOGY OF A CITY-MAN SYSTEM,
California Univ., Los Angeles. Dept. of Geography.
Werner H. Terjung.
Annals of the Association of American Geographers, Vol 60, No 3, September 1970, p 466-492. 29 fig, 6 tab.

Descriptors: *Climatology, *Weather modification, *Environment, Research and Development.
Identifiers: *Energy balance, *Micro-climatology, Radiation, City-man system, Metropolitan Areas.

The urban energy balance climatology of the city and man in the Los Angeles basin was examined during a cloudy day ('Catalina eddy') in September 1968, from about sunrise to sunset, by measuring or estimating solar radiation, net radiation, ground heat flux, actual surface temperature, terrain radiant temperature, radiant sky temperature, and dry and wet-bulb temperature for the physical urban interface. An analagous theoretical model attempted to define the input of energy to the human interface via the solar heat load, and the disposal of human net radiation was shown via the channels of latent, sensible, and body heat flux. In spite of an apparent uniform cloud cover, the energy parameters has considerable areal variation in intensity and trend. During the daylight hours 70% of solar radiation was absorbed. An additional 32% was removed by longwave radiation. Of the net radiation received on the dry surface (47% of solar radiation), about 80% was disposed via sensible heat flux, and the remainder entered the pavement as storage. Air temperatures taken at shelter height were out of phase with the ongoing energy regime and were deemed of dubious value in urban climatic studies. Urban man received only 37% and 70% of the values available at the horizontal pavement for solar radiation and net radiation, respectively. A series of empirical and theoretical models show high correlations with the observations. It appeared that solar radiation and net radiation (physical and human) could have been estimated via the solar constant and appropriate transmissivities. (Wray-Chicago)
W71-04753

2B. Precipitation

METEOROLOGICAL CAUSES OF RAIN FLOOD OCCURRENCES IN THE BASI THE UPPER VISTULA,
State Inst. of Hydrology and Meteorology, W (Poland).
H. Mycielska.
In: Floods and Their Computation, Vol 2, In tional Association of Scientific Hydrology Pu tion No 85 (Unesco-WMO), p 859-866, 196 8 fig, 13 ref.

Descriptors: *Rainfall-runoff relation *Synoptic analysis, *Meteorology, * forecasting, Isohyets, Hydrographs, Rainfall sity, Streamflow forecasting, Storm runoff.
Identifiers: Poland, Vistula River Basin.

Based on analysis of meteorological conditi 21 rainfall floods that occurred in the basin Upper Vistula River in the years 1951-1960, tempt was made to identify and characteriz types of synoptic conditions which led to floo a basis of the work rainfall periods with conti rainfall were taken. Individual floods were sionally caused by a few rainfall periods sepa by intervals in which the rain stopped or dist decreased its intensity. Each rainfall establishes an individual type of synoptic cond An analysis of the meteorological condition made, then, for each of the above-ment periods. An isohyetal map obtained as a res the study of synoptic conditions is presented aforesaid maps show the amount of water s from the basin. In the case of rainfall floods, fore, they are the basis for hydrological fore Acquaintance with the genesis and developm individual types of synoptic conditions gi better opportunity for forecasting flood rai (Knapp-USGS)
W71-04392

RADIATIVE COOLING AS A FUNCTIO TEMPERATURE AND WATER VAPOR IN FREE ATMOSPHERE,
Colorado Univ., Boulder. Dept. of Geophysics; and National Center for Atmosp Research, Boulder, Colo.
Julius London, and Takashi Sasamori.
Journal of Geophysical Research, Vol 75, No 6862-6863, November 20, 1970. 2 fig, 3 ref. Grant GP-3196.

Descriptors: *Heat transfer, *Cooling, mospheric temperature, *Water vapor, matology, Temperature.
Identifiers: *Radiative cooling, *Water-vapo tributions.

Some complexities in studies of atmosp dynamics can be considerably simplified if sui approximations are made in computations of r tive heating and cooling rates in the atmosp Radiative cooling in the troposphere, in absence of clouds, depends largely on the ve distribution of temperature and water vapor. been suggested, however, that a good first app mation to the radiative cooling distribution be a linear dependence on the local free-air perature. This paper reports the results of som culations of radiative flux divergence in mod mosphere to test such an approximation. Radi cooling in a clear atmosphere for winter summer seasons at different latitudes of northern and sourthern hemispheres is compl The models were based on observed mean perature distributions up to 25 mb and obse water vapor distributions up to 500 mb. The puted standard error of estimate as a measu the variation of the calculated cooling rate the regression line S sub c were about plus or 0.33C/day when the corresponding water-v distribution for each latitude and season was This was reduced to plus or minus 0.16C/day a single water-vapor distribution was assumed. indicates that a better approximation for the ing rate could be obtained by use of mul

ession involving both temperature and water ibutions. (HerreranVanderbilt)
-04433

IPORAL DISTRIBUTIONS OF RADIOACTY AND Sr-89/Sr-90 RATIOS DURING NSTORMS,
nsas Univ., Fayetteville. Dept. of Chemistry.
Noyce, T. S. Chen, D. T. Moore, J. N. Beck, . K. Kuroda.
nal of Geogphysical Research, Vol 76, No 3, p 656, January 20, 1971. 11 p, 6 fig, 2 tab, 24 USAEC Contract At- (40-1)-2529.

riptors: *Fallout, *Radioisotopes, *Rainfall, ds, Precipitation (Atmospheric), Cloud cs, Atmospheric physics, Meteorology, Air lation, Climatology.
ifiers: *Stratospheric circulation.

onuclide concentrations for Sr-89, Sr-90, Ce- and Cs-137 were sequentially sampled from ainstorms to study fallout behavior as a func- f rainfall rate and type of storm approximate- onths after the eighth Chinese nuclear explo- f December 27, 1968. Great time variability Sr-89/Sr-90 ratio was found in conjunction a well-developed storm on July 21, but a steady ratio was observed in a stratified sta- pe storm on August 14. Tapping of strato- c air appeared to be the cause of the ratio es. For both storms, a strong trend was found oncentrations of radioisotopes to decrease ncrease in rainfall rate. Detailed discussions teorological factors, including a dilution ef- re given to interpret the experimental data. p-USGS)
04563

IATION AND GROWTH OF ICE FOG ICLES AT FAIRBANKS, ALASKA,
orce Cambridge Research Lab., Bedford, and Alaska Univ., College. Geophysical Inst.
imary bibliographic entry see Field 02C.
04564

TIGATION OF STORM PRECIPITATION ERNS OF THE LOS ANGELES RIVER SAN GABRIEL RIVER DRAINAGE S AND THE SHIFTS IN THE NATURAL PITATION PATTERN PRODUCED BY ICIAL NUCLEATION.
American Weather Consultants, Goleta,

mary bibliographic entry see Field 03B.
4681

T OF COOLING TOWER EFFLUENTS ATMOSPHERIC CONDITIONS IN HEASTERN ILLINOIS, PRELIMINARY RT,
State Water Survey, Urbana.
mary bibliographic entry see Field 06G.
4682

Snow, Ice, and Frost

IEW OF WATER RESOURCES OF THE AREA, NORTHERN ALASKA,
cal Survey, Washington, D.C.
Williams.
cal Survey Circular 636, 1970. 8 p, 2 fig, 2 ref.

tors: *Water resources, *Alaska, *Surface *Groundwater, *Water quality, Stream- easonal, Ice, Permafrost, Frozen soils, ground, Aquifers, Water yield, Hydrologic roundwater movement, Alluvium, Hydrolo- gs, Storage, Recharge.
rs: *Umiat area (Northern Alaska).

In the Umiat area of northern Alaska, surface-water supplied from the Colville River, small tributary creeks, and lakes are abundant in summer but limited in winter by low or zero flow in streams and thick ice cover on lakes. Fresh groundwater occurs in unfrozen zones in alluvium and in the upper part of bedrock beneath the Colville River and beneath lakes that do not freeze to the bottom in winter. Brackish or saline groundwater occurs in bedrock beneath as much as 1,055 feet of permafrost in the Arctic foothills and beneath 750 to 800 feet of permfrost beneath low terraces of the Colville River valley. The foothill area is unfavorable for developing supplies of potable groundwater because of the great depth to water, predominance of brackish or saline water, and low potential yield of the bedrock. In the Colville River valley, shallow unfrozen alluvium beneath the river and deep lakes will yield abundant year-round supplies of groundwater, but the bedrock below permafrost yields less than 10 gallons per minute of saline or brackish water. (Woodard-USGS)
W71-04364

AREAL MEASUREMENTS OF WATER EQUIVALENT OF SNOW DEPOSITS BY MEANS OF NATURAL RADIOACTIVITY IN THE GROUND,
Institutt for Atomenergi, Kjeller (Norway); and Norwegian Water Resources and Electricity Board, Oslo.
J. B. Dahl, and H. Odegaard.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/13, p 191-212, 1970. 22 p, 9 fig, 7 tab, 7 ref.

Descriptors: *Snow surveys, *Nuclear moisture meters, *Water equivalent, *Gamma rays, Snow cover, Water yield, Snowpacks, Calibrations, Snow management, Runoff forecasting, Streamflow forecasting.
Identifiers: *Norway, *Nuclear water-equivalent meters (Snow).

Gamma rays emitted from naturally occurring radioactive elements in the ground are used to measure continuously the water equivalent of snow deposits along selected routes in typical mountain and lowland areas in Norway. The activity measurements have been made from snow scooters and from helicopters flying about 5 and 20 m above ground level. Snow deposits equivalent to 0 - 30 cm of water are measured with an accuracy better than 10% standard deviation as compared with a series of conventional gravimetric measurements. The method is to be applicable to measurements of snow deposits equivalent to 0 - 60 cm of water. An empirical formula is given for computer calculation of snow deposits by this method. The formula is valid for measurements of snow deposits through the winter season. (Knapp-USGS)
W71-04374

RADIOACTIVE TRACING IN FROZEN RIVERS,
Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics; Ceskoslovenska Akademie Ved, Prague. Ustav Jaderneho Vyskumn; and Hydrometeorologicky Ustav, Ostrava (Czechoslovakia).
J. Balek, J. Ralkova, and R. Sochorec.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/28, p 479-482, 1970. 4 p, 2 fig, 3 ref.

Descriptors: *Tracers, *Radioisotopes, *Chromium, *Discharge measurement, *Ice, Streamflow, Stream gages, Velocity, Regime, Discharge (Water), Mixing, Radioactivity techniques.
Identifiers: *Iced rivers.

Time of travel and discharge measurements were made in frozen rivers by means of radioactive tracing. The measurements were made with Cr-51 in two frozen rivers of north Moravia, Czechoslovakia, in 1969. The application of the isotope technique on the time of travel measurement in frozen rivers was considered to be a satisfactory method. The movement of water particles was found to be faster in a channel covered by ice than in a free surface channel when other hydraulic conditions remained unchanged. (Knapp-USGS)
W71-04382

SPRING FLOOD HYDROGRAPH COMPUTATION ON THE BASIS OF DATA ON INFLOW TO THE WATERSHED SURFACE AND INTO THE RIVER SYSTEM,
Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Moscow (USSR).
For primary bibliographic entry see Field 04A.
W71-04406

FORMATION AND GROWTH OF ICE FOG PARTICLES AT FAIRBANKS, ALASKA,
Air Force Cambridge Research Lab., Bedford, Mass.; and Alaska Univ., College. Geophysical Inst.
P. J. Huffman, and T. Ohtake.
Journal of Geophysical Research, Vol 76, No 3, p 657-665, January 20, 1971. 9 p, 5 fig, 15 ref. HEW-NCAPC Grant AP 0049.

Descriptors: *Fog, *Freezing, *Nucleation, *Cooling, *Ice, Alaska, Crystal growth, Cloud physics, Meteorology, Aerosols, Particle size.
Identifiers: *Ice fog.

A mechanism is proposed for the formation of ice fog particles in the city and environs of Fairbanks, Alaska. Equations are developed for calculating the size distribution resulting from growth by deposition of water vapor. The equations are numerically solved with a computer for three major types of ice fog sources: (1) automobile exhaust, (2) exhaust from heating plants, and (3) open water. The size distribution produced by an individual source is determined by the cooling of water vapor injected into the environment. The cooling rate is a function of the source characteristics and the ambient temperature. The proposed mechanism adequately represents the observed size distribution if the cooling rate of the water vapor injected into the environment is not too large (source types 2 and 3). Because of the large cooling rate of the water vapor injected into the atmosphere by source type 1, the size distribution from this source is not adequately represented by the model. In agreement with observations, the computational results predict a decrease in the size of ice fog particles with decreasing ambient temperature for source types 2 and 3. (Knapp-USGS)
W71-04564

2E. Streamflow and Runoff

TRITIUM AND OXYGEN-18 IN NATURAL WATER SAMPLES FROM SWITZERLAND,
Bern Univ. (Switzerland); and Pisa Univ. (Italy).
U. Siegenthaler, H. Oeschger, and E. Tongiorgi.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No Sm-129/22, p 373-385, 1970. 13 p, 10 fig, 16 ref.

Descriptors: *Tritium, *Oxygen, *Hydrogeology, *Radioactive dating, Groundwater movement, Recharge, Discharge (Water), Water balance, Precipitation (Atmospheric), Altitude, Mountains, Lakes, Streamflow, Water sources, Mixing, Surface-groundwater relationships.
Identifiers: *Switzerland, *Alps, *Oxygen isotopes.

Tritium and O-18 concentrations were measured in precipitation samples at various stations in the Alps, in the foothills of the Alps and the Jura region. Mean O-18 concentration and mean annual temperature follow a linear relationship at many, but not all, of the considered stations. The O-18 to altitude relationship varies between different regions. The O-18 and tritium contents in precipitation are used as a basis for interpreting the T/H- and O-18/O-16 ratios observed in rivers and underground waters. A spring in the Alps shows no seasonal variations in either tritium or O-18. O-18 provides information about the mean altitude of its recharge area whereas tritium values allow the computation of the mean residence time of the water in the ground. The isotopic behavior of different inputs (precipitation, lake and river water) to the groundwater downstream from the lake of Thun was investigated. Distinct tritium variations occur with a sharp maximum in winter. This cannot be due to delayed rain from the preceding summer, since O-18 is constant with time. The variations can be explained by assuming several well-mixed reservoirs of different ages with a mixing ratio varying with time. The isotopic compositions of the considered underground waters support the assumption that groundwater recharge occurs uniformly during all seasons. (Knapp-USGS)
W71-04379

STABLE CARBON AND OXYGEN ISOTOPES OF NATURAL WATERS IN THE NETHERLANDS,
Groningen Rijksuniversiteit (Netherlands).
For primary bibliographic entry see Field 02F.
W71-04380

MEASUREMENT OF VARIABLE FLOW PATTERNS BY A METHOD INVOLVING DILUTION OF RADIOACTIVE TRACERS (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 08B.
W71-04383

THE CONCEPT OF 'GOOD MIXING' IN THE USE OF TRACERS: DISCHARGE VELOCITY AND VELOCITY OF THE CENTER OF GRAVITY OF A TRACER CLOUD IN FLOW STUDIES (FRENCH),
Toulouse Univ. (France). Institut de Mecanique des Fluides; and Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 08B.
W71-04384

PEAK DISCHARGE AND TIME OF CONCENTRATION RELATION TO RAIN INTENSITY INVESTIGATED BY PHYSICAL MODELS OF WATERSHEDS,
Prague Agricultural Univ. (Czechoslovakia).
For primary bibliographic entry see Field 02A.
W71-04388

APPLICATION OF PROBABILITY TO SPILLWAY DESIGN FLOOD ESTIMATION,
State Rivers and Water Supply Commission, Melbourne (Australia).
For primary bibliographic entry see Field 08B.
W71-04389

THE FLOOD FORECASTING BY A SERIES STORAGE TYPE MODEL,
National Research Center for Disaster Prevention, Tokyo (Japan).
For primary bibliographic entry see Field 02A.
W71-04390

THE RELATIONSHIP BETWEEN LAG TIME AND THE PHYSICAL CHARACTERISTICS OF DRAINAGE BASINS IN SOUTHERN ONTARIO,
Queen's Univ., Kingston (Ontario).
R. J. Kennedy, and W. E. Watt.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 866-874, 1969. 9 p, 3 fig, 2 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff forecasting, *Peak discharge, *Routing, *Recession curves, Time lag, Effective precipitation, Hydrographs, Precipitation excess, Hydrograph analysis, Statistical methods, Regression analysis.
Identifiers: Ontario, Canada.

Part of the Canadian IHD Programme was intended to develop a standard method of computing the peak rate of runoff corresponding to a selected probability, for drainage basins in the area range of ten to one hundred and fifty square miles. The physical factors thought to have a major effect on the lag time, here defined as the time interval from the midpoint of the excess rain to the center of gravity of runoff, were combined into an equation. Records of a number of isolated storms from each of a dozen drainage basins were analyzed and the actual lag times compared with those indicated by the equation. The final equation, with exponents adjusted, gives lag time in terms of area, shape factor, equivalent slope, storage factor and population factor. (Knapp-USGS)
W71-04391

THE SIGNIFICANCE OF CHARACTERISTICS OF BASIN RAINFALL AND MORPHOMETRY IN A STUDY OF FLOODS IN THE UNITED KINGDOM,
Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 02A.
W71-04393

MEAN DISCHARGE AS AN INDEX TO MEAN MAXIMUM DISCHARGE,
EIE Dept., Ankara (Turkey).
H. Conturk.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 826-833, 1969. 8 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Streamflow, *Discharge (Water), *Stream gages, *Estimating, *Statistical methods, Data collections, Hydrologic data, Regimen, River forecasting, Rainfall-Runoff relationships.
Identifiers: Mean annual flood, Mean discharge, Turkey.

In Turkey, where a variety of climates and physiographic features exists, a network of stream-gaging stations is not yet developed to give a good picture of changes in streamflow, especially of maximum discharges, both in time and space. An attempt is made to approximate mean maximum discharges using average streamflow discharges as an index. The ratio of the mean maximum discharge to average discharge at long-term stations shows a regional variation, almost independent of the size of drainage area. Accordingly, at points, gaged or ungaged, for which recorded or estimated average discharges are available, mean maximum discharge can be estimated. (Knapp-USGS)
W71-04394

THE INFLUENCE OF RESERVOIR STORAGE ON STATISTICAL PEAK FLOWS,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 04A.
W71-04395

CHANGE OF RUNOFF DUE TO URBANIZATION,
Public Works Research Inst., Tokoyo (Japan).
For primary bibliographic entry see Field 04C.
W71-04399

INFLUENCE OF SOILS, VEGETATION A GEOMORPHOLOGY ON ELEMENTS OF T FLOOD HYDROGRAPH,
Agricultural Research Service, Beltsville, M Hydrograph Lab.
For primary bibliographic entry see Field 04A.
W71-04402

FLOOD PLAIN INFLUENCE ON FLOOD WA PROPAGATION ALONG A RIVER,
State Hydrological Inst., Leningrad (USSR).
M. S. Grushevsky.
In: Floods and Their Computation, Vol 2, Inter tional Association of Scientific Hydrology Publi tion No 85 (Wnesco-WMO), p 745-754, 1969. p, 4 fig, 1 tab, 10 ref.

Descriptors: *Discharge (Water), *Floo *Streamflow, *Routing, *Model studies, Math matical models, Hydraulic models, Hydrograp Peak discharge, Unsteady flow, Streamfl forecasting, Flood forecasting, Floods, Flo plains.
Identifiers: Flood wave propagation, USSR.

The decrease of maximum discharge and t change of hydrograph shape along a river as well the propagation rate of wave crest and its relati to mean flow velocity were calculated on the ba of field observations on artificial flood wa propagation on the Tvertza River and spring flo on the Irtysh River, USSR. Comparison of the characteristics along the river reaches with a without a flood plain permits investigation of t flood plain influence. The influence of a flood pla on unsteady flow is being investigated in great detail by means of numerical experiments o hypothetic models of simple channels with flo plains. (Knapp-USGS)
W71-04403

DESIGN HYDROGRAPHS OF SPRING FLOOD AND METHODS OF THEIR COMPUTATIO (BASED ON BYELORUSSIAN RIVER OBSE VATIONS),
Belorusskii Politekhnicheskii Institut, Mins (USSR); and Ministry of Land Reclamation an Water Economics, Minsk (USSR).
M. G. Krasnik, I. M. Livshitz, V. F. Shebecko, and E. A. Bragilevskaya.
In: Floods and Their Computation, Vol 2, Interna tional Association of Scientific Hydrology Publica tion No 85 (Unesco-WMO), p 727-735, 1969. 9 p 4 fig, 3 tab, 2 ref.

Descriptors: *Hydrograph analysis, *Floo forecasting, Snowmelt, Design flood, Flood con trol, Frequency analysis, Model studies, Mathe matical models, Runoff, Discharge (Water) Streamflow forecasting.
Identifiers: Byelorussia, USSR.

Flood control on rivers having an appreciable rat of spring flood runoff should be based on desig flood hydrographs. In order to generalize snowmel runoff of Byelorussian rivers, hydrological data o 60 gaging stations from catchments ranging fro 70 to 36,000 sq km, of which 4-55% was swampy for periods from 15 to 70 years were used. The analysis of typical hydrographs and adequate non dimensional models showed a number of features of their formation specific to the area investigated. The generalized hydrographs are recommended fo use when estimating unstudied rivers. (Knapp-USGS)
W71-04404

THE ESTIMATION OF RUNOFF OF LARGE AND MEDIUM RIVERS PROCEEDING FROM THE RUNOFF OF MINOR RIVERS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 04A.
W71-04407

ALCULATION OF FLOOD DISCHARGES BY EANS OF THE UNIT HYDROGRAPH,
krainskii Nauchno-Issledovatelskii idrometeorologicheskii Institut, Kiev (USSR).
or primary bibliographic entry see Field 04A.
71-04408

SYSTEMS ANALYSIS OF THE LOWER ANGES-BRAHMAPUTRA BASIN,
rvard Univ., Cambridge, Mass.
ter Rogers.
Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 894-909, 1969. 16 3 fig, 4 tab, 8 ref.

scriptors: *Systems analysis, *River basin velopment, *Flood control, *Optimum development plans, *Water resources development, Water pply, Recreation, Saline water intrusion, River ining, Irrigation, Navigation, Hydroelectric wer, Water storage, Reservoir design.
ntifiers: India, Pakistan.

e Lower Ganges and the Brahmaputra join ether in the Province of East Pakistan to form of the major river systems in the world. Each r the rivers flood during the monsoon causing of lives and great damage to crops and proper- The problem of controlling these floods should be considered alone but should be viewed in context of the river system as a whole. The mber of possible combinations of structural and -structural variables for this system is so large conventional methods of analysis are inquate. By use of Systems Analysis techniques a onal plan to control the floods may be made e taking advantage of the complementarities ch exist with other possible uses for the river. In way the production of hydropower, irrigation ng the dry months of the year, provision of quate flow for year round navigation, and the rol of saline intrusion at the delta may be inated into the flood control system by means of ace water and groundwater storage, and river ing works. (Knapp-USGS)
-04410

LUENCE OF UPPER INDUS BASIN ON THE MENTS OF THE FLOOD HYDROGRAPH TARBELA-ATTOCK,
stan Irrigation and Power Dept., Lahore.
iuddin Khan.
loods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 918-925, 1969. 8 p, 3 append.

riptors: *Floods, *Hydrographs, *Regime, ers, *Rainfall-runoff relationships, norphology, Topography, Mountains, Land-, Glaciers, Snowmelt, Storm runoff.
ifiers: Indus River, India.

Indus river rises in the Tibetan Plateau at tions above 18,000 feet. Upon leaving Tibet, llows a tectonic trough and flows northrly until it reaches Nanga Parbat where it s to flow south. The river is steep and runs in a w gorge. There are no lakes or large forests on iver. About one quarter of the area is occuby snow fields and glaciers. The main rock are sedimentary. The narrow valleys of layan rivers subjected to seismic movements a risk of floods caused by earthslides and lides. Glaciers are also known to block the ns. Hydrographs due to snowmelt floods show lual rise and fall. Those due to bursting of gladams, landslide dams, and heavy rains are nent by their steep rise and fall. Bursting of ide dams produce the most severe floods. The loods are smaller as the basin is subject to on rains in only 10% catchment. (Knapp-)
04412

STAGE AND FREQUENCY OF FLOODS IN CENTRAL INDIA,
Ministry of Railways, Lucknow (India).
A. Bhatnagar.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 925-932, 1969. 8 p, 5 fig, 4 ref.

Descriptors: *Stage-discharge relations, *Frequency analysis, *Floods, *Flood forecasting, *Peak discharge, Statistical methods, Data collections.
Identifiers: India.

Annual flood stages at 20 railway bridges with catchment areas varying from 800 sq km to 29,000 sq km in Central India were analyzed to evolve regional stage-frequency relations. A dimensionless regional frequency curve was evolved correlating annual flood stages expressed as a ratio to mean annual flood stage along with the relation of mean annual stage to catchment area. With the help of these two curves momentary peak flood stage for any design frequency can be determined for any catchment in this region. From the second curve the mean annual stage corresponding to the catchment area is determined. This, when multiplied by the ratio of the annual flood stage to the mean annual flood stage for the design frequency, obtained from the first curve, gives the required annual flood stage. (Knapp-USGS)
W71-04413

CONDITIONS LEADING TO THE FORMATION OF RAIN FLOOD FLOW ON SMALL RIVERS IN THE SOUTHERN PART OF THE FAR EAST,
Far Eastern Hydrometeorological Research Inst., Vladivostok (USSR).
For primary bibliographic entry see Field 02A.
W71-04414

DISPERSION CHARACTERISTICS OF THE COLUMBIA RIVER BETWEEN RIVER MILES 383 AND 355,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
J. C. Sonnichsen, Jr., D. A. Kottwitz, and R. T. Jaske.
Battelle Memorial Institute, Pacific Northwest Lab Report, BNWL-1477, October 1970. 32 p, 8 fig, 4 tab, 20 ref.

Descriptors: *Dispersion, *Eddies, Turbulence, Turbulent flow, Tracers, Mixing, Temperature, Dye releases.
Identifiers: *Columbia River, *Eddy Diffusion coefficients, *Longitudinal and Lateral diffusion, Effluent buoyancy.

The area of the Columbia River between miles 383 and 355 has been used by the Atomic Energy Commission and no less than five plutonium-producing and power-producing reactor complexes have been sited on these waters. The purpose of this report is to determine the lateral and longitudinal eddy diffusion coefficients for this section of the river. The techniques employed include both remote sensing systems and physical contact sampling systems. Dye is used as a tracer in both techniques. An empirical examination of the effect of affluent buoyancy on the lateral dispersion coefficient is presented. Results indicate that the lateral diffusion coefficient depends upon density differentials. Values for the longitudinal diffusion coefficient generally range between 500 sq ft./sec and 3000 sq ft./sec for flow rates of 80,000 to 130,000 cu ft./sec. (Herrera-Vanderbilt)
W71-04444

WATER SURFACE CONFIGURATION IN CHANNEL BENDS,
Howard Univ., Washington, D.C. Dept. of Civil Engineering; and Illinois Univ., Urbana. Dept. of Civil Engineering.
Chin-lien Yen, and Ben Chie Yen.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY2, Paper 7928, p 303-321, February 1971. 19 p, 8 fig, 9 ref, append.

Descriptors: *Open channel flow, *Flow profiles, *Meanders, *Channel morphology, Hydraulics, River training, Mathematical studies, Reynolds number, Turbulent flow, Steady flow, Water levels.

Water surface configuration in open-channel bends depends on the geometry of the channel. Mathematical expressions for longitudinal and transverse water surface profiles are derived from the equations of motion with the aid of order of magnitude analysis. Computed surface profiles and superelevation obtained by using mathematical expressions agree well with experimental measurements of subcritical flows in trapezoidal and natural bed meandering models. The result reveals that the channel bed topography is an important factor in determining the superelevation and water surface profiles. Inadequacy of conventional approximate methods to evaluate the superelevation is also examined. (Knapp-USGS)
W71-04575

THEORETICAL PROBABILITY DISTRIBUTIONS FOR FLOOD PEAKS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A
W71-04590

FLOW MEASUREMENTS IN THE DANUBE,
Vienna Univ. (Austria). Institut fuer Radiumforschung und Kernphysik; and Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna.
P. Gehringer, L. Riedlmayer, and H. Rotzer.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/29, p 483-496, 1970. 14 p, 7 fig, 3 tab, 7 ref.

Descriptors: *Tracers, *Tracking techniques, *Discharge measurement, *Stream gages, Navigation, Water levels, Stage-discharge relations, Water level fluctuations, Velocity, Current meters, Mixing, Dispersion, Radioactivity techniques, Sampling.
Identifiers: *Bromine radioisotopes, *Danube River.

The measurement of flow rate in rivers which may undergo marked seasonal changes in depth is highly important both for navigation and for the operation of hydraulic power plants. Nuclear methods, which are known to give very good results in smaller rivers, were applied to larger streams. By contract of the company operating a chain of power stations along the Austrian part of the Danube, dispersion and flow rate measurements with radioactive tracers were carried out in the reach between Aschach and Linz. In this zone, flow rates between 1000 and 7000 cu m/sec may be expected. A combined method of total count and total sample was applied using Br-32 as the tracer. Samples as well as direct measurements were taken simultaneously at various depths from three boats across the river. (Knapp-USGS)
W71-04591

NUCLEAR TECHNIQUES IN STUDIES OF DISPERSION AND SOME OTHER PROPERTIES OF THE DANUBE,
Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia); and Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
T. Tasovac, R. Draskovic, R. Radosavljevic, A. Filip, and V. Vukmirovic.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255,

Paper No SM-129/30, p 497-507, 1970. 11 p, 7 fig, 3 tab, 7 ref.

Descriptors: *Tracers, *Path of pollutants, *Mixing, Diffusion, Dispersion, Discharge measurement, Trace elements, Industrial wastes, Radioactive wastes, Radioecology, Water pollution effects, Water pollution sources, Suspended load, Water quality.
Identifiers: *Danube River.

Systematic tracer investigations of the Danube were made to determine the changes in hydrodynamic, hydrochemical and hydrobiotical properties of the river and to determine increased accumulation of waste material. Radioactive tracers were used to study the dispersion characteristics of the river in different hydrological conditions within the experimental zone of twenty-five kilometers. The properties of the water and suspended material were investigated by neutron activation analysis, and the accumulation of radioactive pollutants in different components of the ecosystem were also studied. Vertical mixing was attained after two kilometers and lateral distribution of radioactive tracer was still not complete eighteen kilometers downstream from the injection point. Twelve kilometers downstream from the injection point, the diffusion coefficients reach a constant value. The maximum concentrations of injected radioactive tracer decrease exponentially along the river course. Radioecological studies by gamma spectrometry show that, in addition to fallout activity, gamma emitting nuclides characteristic of corrosion products are present. (Knapp-USGS)
W71-04592

HYDRAULIC PROPERTIES RELATED TO STREAM REAERATION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-04593

APPLICABILITY OF SHORT-MEMORY MODES TO ENGLISH RIVER-FLOW DATA,
Birmingham Univ. (England).
For primary bibliographic entry see Field 06A.
W71-04770

2F. Groundwater

MECHANICAL COMPACTION OF SANDS CONTAINING DIFFERENT PERCENTAGES OF DUCTILE GRAINS: A THEORETICAL APPROACH,
Shell Oil Co., Houston, Tex.
Gordon Rittenhouse.
American Association of Petroleum Geologists Bulletin, Vol 55, No 1, p 92-96, January 1971. 5 p, 4 fig, 8 ref.

Descriptors: *Porosity, *Pores, *Interstices, *Diagenesis, *Ductility, Compressibility, Plasticity, Sandstones, Permeability, Groundwater movement, Porous media, Void ratio, Voids, Solubility, Sediments, Sedimentary petrology, Sedimentary rocks.
Identifiers: Pore-space, Cementation, Compaction.

The reduction in pore space and thickness caused by plastic deformation of grains has been calculated for different proportions of ductile and nonductile, uniformly sized spheres in orthorhombic packing and for other shapes of grains. The relation for uniformly sized spheres in orthorhombic packing is believed to be applicable to well-sorted and rounded natural sands in which compaction has been extensive, and to be a maximum for angular sands or for very well-sorted and extremely well-sorted, well-rounded sands. Applicability to less well-sorted sands is less certain. In sands in which such plastic deformation has not been complete, less reduction in pore space or thickness may be expected. These relations may be helpful in separating the effects of plastic deformation of grains from those caused by grain rotation of fracturing, solution from points of grain contact, and cementation. Experimental investigation of the relation of ductile grain content to reduction in pore space or thickness is considered desirable. (Knapp-USGS)
W71-04360

PORE-SPACE REDUCTION BY SOLUTION AND CEMENTATION,
Shell Oil Co., Houston, Tex.
Gordon Rittenhouse.
American Association of Petroleum Geologists Bulletin, Vol 55, No 1, p 80-91, January 1971. 12 p, 9 fig, 9 ref, append.

Descriptors: *Porosity, *Pores, *Interstices, *Diagenesia, *Sandstones, Permeability, Groundwater movement, Porous media, Void ratio, Voids, Solubility, Sediments, Sedimentary petrology, Sedimentary rocks.
Identifiers: Pore-space, Cementation, Compaction.

The amount of pore-space reduction caused by solution of grains at points of contact and the additional reduction that would result from precipitation of this dissolved material was investigated. For single grains and their associated pore space such reduction in porosity was calculated for spheres and other geometric forms in various packing arrangements. The relative amounts of porosity reduction may vary greatly, depending on grain shape and angularity, packing, direction of pressure, and amount of solution. The maximum porosity loss by cement relative to porosity loss by solution occurred with spheres in orthorhombic packing, rotated 30 deg. This is believed to be a maximum for any sand and most closely approached by a well-sorted sandstone made up of very well-rounded grains. A maximum cement-to-solution relation is estimated for sandstones of better or poorer sorting or greater grain angularity. The extrapolation from single grains and their associated pores to sandstones is complicated by the possibility of nonuniform solution or cementation. (Knapp-USGS)
W71-04361

RELIABILITY OF CARBON-14 DATING OF GROUNDWATER: EFFECT OF CARBONATE EXCHANGE,
Heidelberg Univ. (West Germany).
L. Thilo, and K. O. Munnich.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No Sm-129/17, p 259-270, 1970. 12 p, 7 fig, 1 tab, 8 ref. IAEC Contract 215/RB.

Descriptors: *Carbon radioisotopes, *Radioactive dating, *Groundwater movement, *Ion exchange, Carbonates, Carbonate rocks, Soil chemistry, Water chemistry, Leaching, Limestones, Recharge, Discharge (Water), Water circulation, Carbon dioxide, Mixing, Tritium.
Identifiers: *Radiocarbon dating (Groundwater), Groundwater dating.

Carbonate exchange was investigated by measuring the flow of a C-14 spiked carbonate solution through columns of a number of different calcareous materials. A reversible exchange was clearly observed by a delay of the C-14 tracer compared with the carrier solution. The extent of this delay amounts to an exchange which is restricted to somewhat less than one molecular layer on the surface of the solid phase. The exchange time is less than about 2 hours. The influence of such an exchange on the C-14 dating of groundwater is limited and can be estimated fairly accurately if the grain size and the relative carbonate concentrations of the aquifer are known. An additional irreversible carbonate exchange was shown by larger and permanent losses of C-14 from the liquid phase, especially at higher temperatures. The perature dependence for this process was meas and, when extrapolated, pointed to signif losses of C-14 at 10 deg C within time inte comparable to the lifetime of C-14. A compa between the concentration of bomb-produce 14 in the atmosphere with the concentration subsequently appears in a shallow aquifer, sh no clear evidence of carbonate exchange. (Kn USGS)
W71-04372

CARBON-14 DATING OF GROUNDWATER
Council for Scientific and Industrial Research, toria (South Africa). National Physics Rese Lab.
J. C. Vogel.
In: Isotope Hydrology, 1970, Proceedings Sym um of International Atomic Energy Agency UNESCO, Vienna, March 9-13, 1970: Vienn ternational Atomic Energy Agency STI/PUB/ Paper No SM-129/15, p 225-239, 1970. 15 p, 2 tab, 13 ref.

Descriptors: *Carbon radioisotopes, *Deute *Tritium, *Groundwater movement, *Radioa dating, Groundwater, Soil water, Rech Discharge (Water), Water chemistry, Carbon Water circulation, Leaching, Carbon dioxide, ing.
Identifiers: *Groundwater dating, *Radioca dating (Groundwater).

The expected age distribution of water in diff types of aquifers with primary and secon permeability is discussed and examples given markably uniform flow is sometimes observed distances of several kilometers with secon permeability, and average flow rates ca deduced even where the strata are too hetero ous to apply pumping tests. The apparent a spring water emerging from an unconfined aq as calculated from the C-14 or tritium con can be used to calculate the average age o water in the aquifer and thence the rate of rec and storage capacity. Such apparent ages pro means of directly comparing tritium and C-14 The initial C-14 content of groundwater is fou be about 85% of the modern value in both h and arid climatic regions. The magitude of a p ble loss of C-14 from the groundwater by is exchange with solid carbonate appears to be tively small in practice and C-14 ages are pro no more than 20 to 30% too high, even unde favorable conditions. (Knapp-USGS)
W71-04373

ISOTOPE TECHNIQUES APPLIED GROUNDWATER MOVEMENT IN KONYA PLAIN,
State Hydraulic Works, Ankara (Turkey).
For primary bibliographic entry see Field 04B.
W71-04375

CARBON-14 CONCENTRATION OF LIM SOILS AND ASPECTS OF THE CARBO DATING OF GROUNDWATER,
Niedersaechsisches Landesamt Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 02G.
W71-04376

SEQUENTIAL SAMPLING OF RADIOCAR IN GROUNDWATER,
Instituto Venezolano de Investigaciones tificas, Caracas; and Soil Science Inst., Bonn Germany).
M. A. Tamers, and H. W. Scharpenseel.
In: Isotope Hydrology, 1970, Proceedings Sym um of International Atomic Energy Agency UNESCO, Vienna, March 9-13, 1970: Vienn ternational Atomic Energy Ag STI/PUB/255/16, p 241-257, 1970. 17 p, 7 tab, 21 ref.

criptors: *Carbon radioisotopes, *Tritium, dioactive dating, *Groundwater movement, estones, Carbonates, Leaching, Recharge, harge (Water), Groundwater, Water chemis- Carbonate rocks, Water circulation, Carbon- ide, Mixing.
tifiers: *Radiocarbon dating (Groundwater), ndwater dating.

nt artificial variations in atmospheric carbon contents are used in the evaluation of velocities in young groundwater systems. t age determinations are possible if a periodic ling program is established. The changing carbon concentrations of the groundwater nate species, after correction for limestone on, can be fitted to known excesses in plants the past two decades. Three aquifers have studied by this technique. Four annual lings are shown for the Lake of Valencia and arquisimeto groundwaters in Venezuela, and samplings for the Koln 07 system in the al Republic of Germany. The best fit is ob- for Barquisimeto, where groups of data from wells along the aquifer axis were used in the ation of a flow velocity of 100 meters per The well closest to the outcrop produces with an apparent age of 3.5 years and the last 10.5 years. Tritium contents, which were ired in the Koln 07 series, are not in good ment with the radiocarbon values. (Kanpp-)
04377

RIBUTION OF ENVIRONMENTAL UM MEASUREMENTS TO SOME YDROLOGICAL PROBLEMS IN HERN AFRICA,
rsity of the Witwatersrand, Johannesburg Africa); Botswana Geological Survey, e.
Verhagen, J. P. F. Sellschop, and C. M. H. gs.
ope Hydrology, 1970, Proceedings Symposi- International Atomic Energy Agency and CO, Vienna, March 9-13, 1970: Vienna, In- onal Atomic Energy Agency STI/PUB/255, No Sm-129/58, p 289-313, 1970. 25 p, 9 fig, 3 ref.

tors: *Tritium, *Groundwater movement, rs, Hydrogeology, Tracers, Tracking ues, Radioactive dating, Sampling, Water Water balance, Climates, Weather, ge, Discharge (Water), Water yield.
ers: *Botswana.

tsi and Serowe, Botswana, measurements of mental tritium content are compared with rological features as determined by conven- ethods. A confined and simple aquifer is tudy, to act as a test bench for the in- tion of results on a large scale. The concen- encountered are generally very low (0-5 ut significant variations occur, even over stances. From these variations likely areas rge and storage capacity are determined. A sampling program is under way in these number of boreholes were chosen for sam- regular intervals and at specific depths. of poor rainfall during the survey, and the period covered, little time variation has so observed. Groundwater age stratification demonstrated by spot sampling in some ex- reholes. (Knapp-USGS)
378

M AND OXYGEN-18 IN NATURAL SAMPLES FROM SWITZERLAND,
iv. (Switzerland); and Pisa Univ. (Italy).
ary bibliographic entry see Field 02E.
379

CARBON AND OXYGEN ISOTOPES TURAL WATERS IN THE NETHER-

n Rijksuniversiteit (Netherlands).
W. G. Mook.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No Sm-129/12, p 163-190, 1970. 28 p, 15 fig, 4 tab, 21 ref.

Descriptors: *Stable isotopes, *Carbon, *Oxygen, *Water chemistry, Water balance, Groundwater, Surface waters, Sea water, Water sources, Hydrologic cycle, Evaporation, Precipitation (Atmospheric), Estuaries, Mixing, Carbonates, Water temperature.
Identifiers: *The Netherlands.

The carbon and oxygen isotopes in the Dutch surface water and groundwater present an internally consistent picture of the hydrologic cycle. The O-18 content of the average annual precipitation is -7.9 parts per thousand. The groundwater generally reflects the isotopic composition of precipitation during the seasons of maximum infiltration. River water appears to have a component derived from groundwater. The C-13 of the dissolved bicarbonate generally varies between -12 and -8 parts per thousand, largely due to isotope exchange with the atmospheric CO2. Rivers supplied by meltwater and rainwater show opposite variations in O-18 content, the Rhine from -9 to -10 parts per thousand and the Vecht from -7.5 to -6.5 parts per thousand between winter and summer respectively. In an estuary the isotopic compositions of the bicarbonate and the water turn out to be solely determined by the mixing ratio of the fresh and sea water. The O-18 chlorinity relation yields a straight line, whereas the similar relation for C-13 gives a smooth curve, the form depending on the relative quantities of dissolved carbon in the fresh and sea water. In the lake Ijsselmeer the C-13 content approaches an isotopic equilibrium with atmospheric CO2 along the flow direction, due to the relatively long residence time of the water in the lake. (Knapp-USGS)
W71-04380

SOURCES OF DISSOLVED CARBONATE SPECIES IN GROUNDWATER AND THEIR EFFECTS ON CARBON-14 DATING,
Geological Survey, Washington, D.C.
F. J. Pearson, Jr., and B. B. Hanshaw.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/18, p 271-286, 1970. 16 p, 4 fig, 1 tab, 15 ref.

Descriptors: *Radioactive dating, *Groundwater, *Water chemistry, *Carbonates, Chemical reactions, Solubility, Aqueous solutions, Leaching, Ion exchange, Carbon radioisotopes, Stable isotopes.
Identifiers: *Carbon-14 dating, *Carbon isotopes, *Carbon isotope ratios.

The sources of dissolved carbonate species in groundwater systems must be known in order to correct C-14 measurements to determine true or to correct relative groundwater ages. The contributions of the various sources can be estimated from C-13/C-12 ratios and from total carbonate content measurements on the water. Atmospheric precipitation generally contains no dissolved carbonate; the initial carbonate dissolved in groundwater comes from the soil atmosphere and soil carbonate minerals. Theoretical considerations and field studies in Florida, New York, and Texas show that carbonate dissolved from the soil air has values of delta C-13 of about (-) 25 parts per thousand, and the C-14 value is about the same as recent values; these are identical with those of plants. The major source of additional carbonate in deeper parts of a groundwater system is solution of carbonate minerals. In nearly pure carbonate systems, such as the principal Floridan aquifer, this solution about doubles the content of dissolved carbonate species, and delta C-13 is about 1.2% and true C-14 is about twice that measured. Where ionic interaction is affected by silicate dissolution, cation exchange, or mixing of dissimilar waters, the dissolved carbonate content can increase further. Several no non-mineral sources may also add dissolved carbonate to groundwater. Isotope exchange theoretically could change the ratios, but field studies show no evidence that exchange occurs in the temperature range of most groundwaters. (Knapp-USGS)
W71-04381

GROUNDWATER MEASUREMENTS AT THE SITE OF THE SYLVENSTEIN DAM IN THE BAVARIAN ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
W. Drost.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/25, p 421-437, 1970. 17 p, 14 fig, 1 tab, 8 ref.

Descriptors: *Radioisotopes, *Stable isotopes, *Tracers, *Reservoir leakage, Grouting, Deuterium, Seepage, Oxygen, Water loss, Groundwater movement, Tracking techniques, Water temperature, Sampling, Flow, Porous media, Nuclear moisture meters, Radioactivity techniques.
Identifiers: *Alps, *Bavaria, *Oxygen isotopes.

At the site of the Sylvenstein dam in the Bavarian Alps, 14 series of groundwater measurements were made between 1961 and 1969 to determine seepage rates and seepage paths through the grout curtain of the gravel-filled dam. Borehole dilution techniques, temperature measurements, and D- and O-18 measurements were carried out. Measurements were made at 50 groundwater points in front of and behind the grout curtain. Taking the average flow line density to calculate seepage rate, a mean value of 50 liters/sec was derived. This seepage rate did not vary during the observation period and is considerably lower than the original groundwater flow of 150 liters/sec. (Knapp-USGS)
W71-04385

ISOTOPIC HYDROLOGICAL STUDIES OF THE NORTHWEST SAHARA (FRENCH),
Centre de Recherches sur les Zones Arides, Paris (France); and Paris Univ. (France). Faculte des Sciences.
For primary bibliographic entry see Field 02A.
W71-04386

STORM RUNOFF FROM FORESTED CATCHMENTS BY SUBSURFACE ROUTES,
Forest Service (USDA), Columbus, Ohio. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W71-04401

BROMIDE AND IODIDE IN OILFIELD BRINES IN SOME TERTIARY AND CRETACEOUS FORMATIONS IN MISSISSIPPI AND ALABAMA,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
A. Gene Collins, William P. Zelinski, and Cynthia A. Pearson.
Bureau of Mines Report of Investigations 6959, June 1967. 27 p, 1 fig, 3 tab, 52 ref.

Descriptors: *Groundwater, *Oil fields, *Chemical analysis, *Halogens, *Chemical reactions, Geochemistry, Brines, Mississippi, Alabama, Geology, Water, Oil, Petrology, Chlorides, Sedimentary petrology, Rocks, Geologic formations, Sampling, Data collections, Sediments, Tertiary period.
Identifiers: *Oilfield brines, (Ala. and Miss.), Bromide, Iodide, Cretaceous formation.

The Bureau of Mines investigated the bromide and iodide content of Mississippi and Alabama oilfield

waters of the Tertiary and Cretaceous period to determine genetic relationships of the ions, to determine their origin, and to determine their genetic relation to petroleum. The 280 samples were analyzed after a pretreatment to remove interferences. The iodide was oxidized to iodate and was titrated with thiosulfate. The bromide was oxidized to bromate and was determined iodometrically. A computer was used to calculate the correlation coefficients of iodide to bromide and to other ions. The other ions are sodium plus potassium, calcium, magnesium, chloride, bicarbonate, and sulfate. The mineral content of the samples ranged from 52 to 1,760 mg/liter for bromide and from 2 to 65 mg/liter for iodide. The mean bromide-to-chloride and iodide-to-chloride ratios were 0.0065 and 0.0002. The correlation coefficient matrix and linear plots indicated a definite bromide-to-calcium relationship for the brines investigated. (Woodard-USGS)
W71-04417

MANAGEMENT AND ADMINISTRATION OF GROUNDWATER IN INTERSTATE AND INTERNATIONAL AQUIFERS, PHASE I,
Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.
For primary bibliographic entry see Field 04B.
W71-04541

NUMERICAL SIMULATION OF DISPERSION IN GROUNDWATER AQUIFERS,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-04559

SALT WATER INTERFACE DURING GROUNDWATER PUMPING,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Science and Engineering.
For primary bibliographic entry see Field 04B.
W71-04571

COMMON STRATIGRAPHIC BOUNDARIES ASSOCIATED WITH COASTAL PLAIN AQUIFERS,
Maryland Geological Survey, Baltimore.
Harry J. Hansen.
Groundwater, Vol 9, No 1, p 5-12, January-February 1971. 8 p, 10 fig, 21 ref.

Descriptors: *Model studies, *Groundwater movement, *Aquifers, *Stratigraphy, *Boundaries (Surfaces), Coastal plains, Maryland, Analog models, Mathematical models, Hydraulic models, Hydraulic similitude, Water levels, Water wells, Water yield.
Identifiers: Aquifer models, Aquifer simulation.

There is a tendency during the verification stage of aquifer model building to manipulate stratigraphic boundaries. This procedure is acceptable insofar as the geohydrologist is sufficiently knowledgeable to sense the point at which the manipulations encroach upon the integrity of his model. Examples from the Maryland Coastal Plain are used to depict several types of stratigraphic boundaries. These include erosional truncation, overlap (or pinchout), disconformity, and facies change. Defining statements are given for each in order to clarify the stratigraphic implications of boundary modeling. (Knapp-USGS)
W71-04577

USE OF GROUNDWATER IN DEVELOPING THE MEKONG DELTA, REPUBLIC OF VIET NAM,
Earth Science Research Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 04B.
W71-04579

TYPE-CURVE SOLUTION OF STEP-DRAWDOWN TEST,
Layne Northern Co., Inc., Lansing, Mich.
N. Thomas Sheahan.
Groundwater, Vol 9, No 1, p 25-29, January-February 1971. 5 p, 2 fig, 2 ref.

Descriptors: *Aquifers, *Drawdown, *Water level fluctuations, Laminar flow, Groundwater movement, Theis equation, Thiems equation, Water table, Water wells, Withdrawal, Hydraulics, Transmissivity, Storage coefficient.
Identifiers: *Drawdown type-curves, *Aquifer testing, *Pumping tests, *Rorabaugh equation.

A set of type-curves is presented which simplifies and quickens the solution of the Rorabaugh equation for drawdown in a pumping well by eliminating the trial-and-error computations. Type-curve analysis of test data in the field, before pumping is discontinued, provides an indication of the accuracy, test data should cover the portion of maximum curvature of the curve, and the range between the lowest and the highest pumping rates used in the step-drawdown test should be great enough to define a unique curve. (Knapp-USGS)
W71-04580

RECHARGE CHARACTERISTICS OF A WATERCOURSE AQUIFER SYSTEM AT SPRINGFIELD, OHIO,
Geological Survey, Columbus, Ohio; and Ohio Dept. of Natural Resources, Columbus. Div. of Water.
For primary bibliographic entry see Field 04B.
W71-04581

A HYDROGEOPHYSICAL SURVEY USING REMOTE-SENSING METHODS FROM KAWAIHAE TO KAILUA-KONA, HAWAII,
Hawaii Univ., Honolulu. Dept. of Geology; and Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 07B.
W71-04582

VERTICAL ZONING IN CHEMICAL COMPOSITION OF GROUNDWATER IN MASSIFS OF EASTERN MONGOLIA AND SOUTHEASTERN TRANSBAIKAL,
Akademiya Nauk SSSR, Moscow. Research Lab. of Foreign Geology.
For primary bibliographic entry see Field 02K.
W71-04584

TRACER DISPERSION IN GROUNDWATER EXPERIMENTS,
Institute of Nuclear Physics, Krakow (Poland).
A. Lenda, and A. Zuber.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/37, p 619-641, 1970. 23 p, 7 fig, 3 tab, 31 ref.

Descriptors: *Tracers, *Dispersion, *Groundwater movement, On-site tests, Pumping, Water wells, Aquifers, Radioactivity techniques, Tracking techniques, Diffusion, Mixing, Flow, Porous media, Mathematical studies, Statistical methods.
Identifiers: *Groundwater dispersion, *Aquifer tests, *Aquifer evaluation, *Pumping tests.

Theoretical problems of the two-well and multi-well tracer techniques generally used for measurements of natural groundwater velocities are discussed. Analytical solutions are given for different measurement geometries. For a point injection and a line injection in an infinite medium, theoretical breakthrough curves are given graphically in a normalized form. They allow estimation of the amount of tracer or carrier needed. They can also be used to find the appropriate transit time and dispersion coefficient from the measured breakthrough curves. Approximate analytical solutions for radial flow are also given graphically. All the formulas are valid for any value of the dis sionless dispersion parameter. Comparison o theoretical solutions with several experim shows their applicability. For planning a field periment the dispersion parameter has to known; therefore, existing theoretical, labora and field data on dispersion coefficients were c piled and are given in a comprehensive form napp-USGS)
W71-04598

APPLICATION OF THE SINGLE-W TECHNIQUE THROUGH THE LABELLING THE WHOLE PIEZOMETRIC COLU (SPANISH),
Ministry of Public Works, Madrid (Spain). Dep Nuclear Applications.
E. Baonza, A. Plata, and E. Piles.
In: Isotope Hydrology, 1970, Proceedings Symp um of International Atomic Energy Agency UNESCO, Vienna, March 9-13, 1970: Vienna ternational Atomic Energy Agency STI/PUB/ Paper No SM-129/42, p 695-711, 1970. 17 p, 9 ref.

Descriptors: *Tracers, *Radioactive well log *Groundwater movement, Hydrogeol Aquifers, On-site tests, Tracking techniq Borehole geophysics, Tagging, Sampling.
Identifiers: *Aquifer testing.

A tracer method for aquifer testing is based on simultaneous labelling of the whole colum water in the borehole and the immediate stud its behavior. The probes used were enclosed in ries of tubes in which perforations cover a kn percentage of their lateral surface. If no ver flow exists, the horizontal velocity can be m sured. The presence of turbulent vertical results in the progressive disappearance of tracer from the area in which the flow origin towards the area of horizontal displacement. In case of aquifers in limestone or other hard for tions, this technique makes it possible to pinp the fissures through which the water circulates. principal advantages of this method are: (a) ra ty in obtaining results; (b) simultaneous suppl information over all the piezometric column; (c) simplicity. This technique, used repeatedl studies of underground water carried out at var points in Spain, including the Costa del Sol, yi qualitative and quantitative information ab characteristics of the aquifers. Its use prior to o more complete but slower and more co methods can give results which make it possibl orientate subsequent work in the most us direction. (Knapp-USGS)
W71-04602

HYDROGEOLOGY OF THE AR SOUTHWEST OF DUVANJSKO POLJE,
Institute for Geological and Geophysical Resea Belgrade (Yugoslavia).
J. Vilimonovic.
Trans. From Vesnik Zovoda Za Geolosk Geofizicka Istrazivanja, Ser B, No 8, p 131- 1968. Available from NTIS as TT 68-50062. letin of Engineering Geology and Hydrogeol Ser B, No 8, p 117-124, 1968. 8 p, 4 fig, 5 re map.

Descriptors: *Hydrogeology, *Karst, Hydrol Geology, Geomorphology, Topography, Stra raphy, Groundwater movement, Aquif Aquicludes, Structural geology.
Identifiers: *Yugoslavia.

The hydrogeology of a karstic region of the ou Dinarides in Yugoslavia, which includes groundwater divide of the drainage basins of rivers Cetina and Neretva and the direct drain basin of the Adriatic Sea, is described with part lar reference to the relationships between perm ble and impermeable rocks. The lithology and tectonics of the area, hydrogeological geomorphological phenomena associated with flow of groundwater, and the hydrogeology and

ctions of flow of groundwater are reviewed. (K-p-USGS)
1-04609

METHOD OF STUDYING THE DRODYNAMIC REGIME OF KARST UIFERS BY ANALYSIS OF THE CHARGE CURVE AND LEVEL FLUCTUA-NS DURING RECESSION,
tute for Geological and Geophysical Research, rade (Yugoslavia).
lijatovic.
is. from Vesnik Zavoda Za Geoloska i fizicka Istrazivanja, Ser B, No 8, p 43-81, 1968. lable from NTIS as TT-68-50062. Bulletin of neering Geology and Hydrogeology, Ser B, No 41-74, 1968. 34 p, 14 fig, 9 tab, 11 ref.

riptors: *Karst, *Hydrogeology, *Recession es, *Hydrograph analysis, Water yield, Transvity, Storage coefficient, Water levels, odynamics, Groundwater movement, Water fluctuations.
ifiers: *Karst hydrogeology, Yugoslavia.

hydrodynamics of karst aquifers may be stu- by analysis of the recession curves of the ograms of springs and watercourses and by is of water level fluctuations. Its great ad-ge is the simple determination of geological parameters: exhaustion coeffi-, storage coefficient, transmissibility, and icient of effective infiltration, which are essen-or various calculations of the water balance eserves. The fundamental hydraulic parame-which all the calculations are based is the ex-ion coefficient, which qualitatively expresses elationship between aquifer geometry and logy. The functional relationship between a he transmissibility and the storage coefficient nd by analysis of the recession equation. The acy of the results depends exclusively on the hydrometric observation data. (Knapp-)
04611

ROGEOLOGICAL POSSIBILITIES FOR E EFFICIENT INTERCEPTION OF UNDWATER IN KARST,
ute for Geological and Geophysical Research, ade (Yugoslavia).
imary bibliographic entry see Field 03B.
04612

Water in Soils

LABLE MOISTURE STORAGE CAPACI-OF SOME LIMESTONE DERIVED SOILS,
uri Univ., Columbia.
Andrew Ruppert.
Thesis, Missouri University Graduate School, y 1970. 110 p, 33 fig, 11 tab, 38 ref, 3 ap-OWRR Project B-022-MO (1).

ptors: *Soil moisture, *Soil structure, *Soil-plant relationships, *Limestones, *Soil water ent, Soil types, Storage capacity, Clays, Soil ties, Porosity, Soil tests, Soil surfaces, tion effects, Infiltration, Earth-water inter-Soil compaction.
iers: *Limestone-derived soils.

noisture storage capacities of limestone d soils were studied in relation to the depths onate rock. The major site picked for this vas an area in Missouri where depth to car- rock decreased with distance, and where, at cal depth to bedrock, a natural boundary n forest and prairie vegetation existed. The ere characterized in order to establish their ty to limestone derived soils previously stu-he available moisture storage capacities of oils were determined in order to observe the s in available moisture storage capacity as-d with varying depths to carbonate rock. The consumptive demand for moisture was estimated at the soil sites in order to test the hypothesis that periods of drought existed in the shallower soils while the deeper soils were able to supply moisture throughout the growing season. A vegetative survey was made in order to relate the vegetative pattern to the depths to bedrock, the available moisture storage capacities, and the consumptive moisture demand. As the depth to carbonate rock varies from 10-50 inches the maximum bulk density of the soil profile increases from 0.8 to 1.5 g/cc. (Woodward-USGS)
W71-04365

STUDY OF A DOLOMITIC AQUIFER WITH CARBON-14 AND TRITIUM,
Department of Water Affairs, Pretoria (South Africa); and Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.
D. B. Bredenkamp, and J. C. Vogel.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No Sm-129/21, p 349-372, 1970. 24 p, 8 fig, 5 tab, 11 ref.

Descriptors: *Carbon radioisotopes, *Tritium, *Tracers, *Radioactive dating, *Groundwater movement, Hydrogeology, Water storage, Recharge, Discharge (Water), Springs, Aquifers, Water balance, Transmissivity, Carbonates, Carbonate rocks, Dolomite.
Identifiers: *Transvaal (S. Africa).

The Dolomite Series which outcrops over an extensive area of the Transvaal is frequently subdivided into separate groundwater compartments by vertical diabase dykes to form well-defined aquifers which usually overflow in strong springs at the lowest point on the surface. The hydrology of one such compartment was analyzed to provide figures for the aquifer characteristics which can be compared with the results of isotope data. The recharge rate of the aquifer is 17.7 mm/yr and the storage capacity is about 57 times the annual recharge. The initial C-14 content of the groundwater varies from 80 to 90% with the result that this isotope is relatively unsuitable for quantitative deductions. Both C-14 and tritium show a linear increase in age with depth in accordance with the theory. From the tritium results a recharge rate of 11.5 mm/yr, and a storage capacity of 106 times the annual recharge are deduced. Practically the same results are obtained from the tritium content of the spring water if the initial tritium content of the recharge, extrapolated from the age-depth curve (7 TU), is used and the relationship between average age and apparent age of the discharge employed. (Knapp-USGS)
W71-04371

CARBON-14 CONCENTRATION OF LIME IN SOILS AND ASPECTS OF THE CARBON-14 DATING OF GROUNDWATER,
Niedersaechsisches Landesamt fuer Bodenforschung, Hanover (West Germany).
M. A. Gehy.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/14, p 215-223, 1970. 9 p, 1 fig, 2 tab, 15 ref.

Descriptors: *Carbon radioisotopes, *Groundwater, *Radioactive dating, *Soil water, Soil water movement, Soil chemistry, Water chemistry, Infiltration, Water circulation, Recharge, Carbonates, Leaching, Carbon dioxide, Mixing.
Identifiers: *Groundwater dating, *Radiocarbon dating (Groundwater).

Carbon-14 age determinations of groundwater are based on the assumption that the soil lime which is dissolved during the passing of CO2-containing rain water is free of radiocarbon. In contrast to this the results of the C-14 determinations from recent groundwaters do not agree with the theoretical values of the dilution factor determined from the content of free and fixed carbonate species of the groundwater. In all cases the mean C-14 concentration of the groundwater was higher than expected in theory even if corrections of an improved water dating model have been used. Measurements of the C-14 concentration of more than ten different soils show that the basic assumption is not correct. The carbonate in the uppermost layer of the soil have a C-14 content between 2 and 70% modern, normally lying within a range of 2 to 15% modern. It is supposed that this radiocarbon is accumulated during the summer with its low recharge rate by precipitation of lime when the water in the uppermost layer is evaporated. During the time of highest groundwater recharge this lime will be dissolved by the leak water and transported to the aquifer. On the supposition that such or a similar process corresponds to the common mechanism in nature, the calculations show that the previously measured C-14 concentrations of recent groundwaters are in accordance with the theoretical values. (Knapp-USGS)
W71-04376

THE ROUTINE ESTIMATION OF SOIL MOISTURE DEFICITS,
British Meteorological Office, Bracknell (England).
J. Grindley, and F. Singleton.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 811-820, 1969. 10 p, 4 fig, 7 tab, 6 ref.

Descriptors: *Soil moisture, *Moisture content, *Water supply, *Flood forecasting, *Evapotranspiration, Water balance, Infiltration, Antecedent precipitation, Effective precipitation, Storm runoff, Streamflow forecasting, Mapping.
Identifiers: Soil moisture deficit, United Kingdom.

Since the autumn of 1962 the United Kingdom Meteorological Office has issued maps of estimated soil moisture deficit to authorities concerned with flood warning and water supply. The method of estimation is to assume a zero deficit during the late winter and thereafter to calculate the cumulative effect of rainfall minus evaporation. Assessment of evaporation is made using a shortened version of Penman's formula. Allowance is made for the inhibition of evaporation from vegetation when soil moisture deficits are large, and the variation of this effect with root length. When considered important, maps of effective precipitation are also issued. Effective precipitation during a period is defined as the excess precipitation over and above that needed to make good the soil moisture deficit which existed at the beginning of the period, with allowance being made for evaporation. Examples of both types of map are shown and their use to river authorities is discussed. (Knapp-USGS)
W71-04396

DETERMINATION OF STORM RUNOFF BY THE USE OF INFILTRATION INDEX,
Ministry of Railways, Lucknow (India).
For primary bibliographic entry see Field 02A.
W71-04397

STORM RUNOFF FROM FORESTED CATCHMENTS BY SUBSURFACE ROUTES,
Forest Service (USDA), Columbus, Ohio. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W71-04401

USE OF GAMMA EMISSION FROM AMERICUM-241 TO MEASURE THE WATER CONTENT OF NONSATURATED SOIL SAMPLES (FRENCH),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.

G. Vachund, J. Cisler, J. L. Thony, and L. de Backer.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/39, p 643-661, 1970. 19 p, 8 fig, 2 tab, 16 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Gamma rays, Calibrations, Instrumentation, Soil moisture, Soil water, Moisture meters, Nuclear meters, Radioactivity techniques.
Identifiers: *Nuclear soil moisture meters.

Because americium-241 has a narrow, well-defined main peak corresponding to the emission of a 60-keV gamma ray, it is very useful for soil water measurements by the gamma-attenuation method, the main advantage being the thinness of the shield needed to protect the source. The gamma radiation emitted by a 0.1-Ci source is collimated into a beam 4 mm in diameter. The source-detector assembly can be moved so as to permit surveying of the sample in a vertical plane. By making a depression at the base of the sample it can be saturated or desaturated, and the changes in water content between the two states of equilibrium can be followed by the gamma-attenuation method. For the measurement geometry used in the tests described, the mass attenuation coefficient of the water is only 0.1788 g/ sq cm, its theoretical value being 0.204. Improved collimation gives 0.1998 g/ sq cm. The results obtained with moderate collimation can be very accurate, provided that the corresponding value of the attenuation coefficients is carefully determined. (Knapp-USGS)
W71-04599

WATER-FLOW CALCULATIONS BY MEANS OF GAMMA-ABSORPTION AND TENSIOMETER FIELD MEASUREMENTS IN THE UNSATURATED SOIL PROFILE,
Niedersaechsisches Landesamt fuer Bodenforschung, Hanover (West Germany); and Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
W. Giesel, S. Lorch, M. Renger, and O. Strebel.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/40, p 663-672, 1970. 10 p, 4 fig, 12 ref.

Descriptors: *Soil water movement, *Soil moisture meters, *Tensiometers, *Water balance, Evapotranspiration, Instrumentation, Soil moisture, Nuclear moisture meters, Hydraulic conductivity, On-site tests, Consumptive use.
Identifiers: *Soil water flowmeters, *Soil densitometers.

By means of a double-probe densitometer and a tensiometer, variations in the soil water content and soil moisture suctions may be determined as a function of time in different horizons of a soil profile. From these data are computed the water flow, evapotranspiration, and exchange of moisture between the soil and groundwater zones. By including the precipitation, the essential components of the water balance equation are measured. In addition, it is possible to obtain from the field measurements the relations between soil water suction and hydraulic conductivity for the individual horizons of a profile. (Knapp-USGS)
W71-04600

PENETRATION RADIOACTIVE LOGGING FOR THE STUDY OF NON-SATURATED AND SATURATED AREAS (RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 04B.
W71-04601

RADIOMETRIC METHOD FOR INVESTIGATING THE PERMEABILITY OF RESERVOIR BEDS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 04A.
W71-04603

NEUTRON INVESTIGATION OF THE RATE OF WATER SEEPAGE FROM IRRIGATION CHANNELS AND RESERVOIRS IN LOESSIAL LOAMS (RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 04A.
W71-04604

2H. Lakes

EFFECTS OF A CAUSEWAY ON THE CHEMISTRY OF THE BRINE IN GREAT SALT LAKE, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 04C.
W71-04369

DEUTERIUM AND OXYGEN-18 IN WATER OF LAKE CHAD (FRENCH),
Paris Univ. (France). Faculte des Sciences; Comitato Nazionale per le Ricerche Nucleari, Pisa (Italy). Laboratorio di Geologia Nucleare; and Office de la Recherche Scientifique et Technique Outre-Mer, Fort-Lamy (Chad).
J. Ch. Fontes, R. Gonfiantini, and M. A. Roche.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/23, p 387-404, 1970. 18 p, 11 fig, 3 tab, 20 ref.

Descriptors: *Deuterium, *Oxygen, *Stable isotopes, *Lakes, *Water balance, Evaporation, Inflow, Streamflow, Precipitation (Atmospheric), Hydrogeology, Sampling, Arid lands, Climates, Water chemistry, Water temperature.
Identifiers: *Lake Chad, *Oxygen isotopes.

Lake Chad is a water body, without outlet, of approximately 20,000 sq km in the heart of tropical Africa. In this semi-arid zone with a climate ranging from the western-Sahara to the sub-desert type, the high rate of evaporation (over 2 m per year) gives rise to an extensive isotopic tracing effect in the surface waters. The proportions and nature of the hydrogeological problems of this internal drainage basin of more than 2 million sq km provide justification for the use of isotope techniques. Four pluviometric stations situated at the north and south of the lake provide a means for evaluating the weighted mean isotopic composition of rainfall on the lake. Weekly sampling and gaging carried out on the Chari River (accounting for 94% of the inflow from rivers) indicates an annual isotopic modulus of -3.3 parts per thousand O-18 vs SMOW in 1967 and-2.8 parts per thousand in 1969. The heavy isotope content increases with distance from the mouth of the Chari. The increase amounts to 20 parts per thousand in oxygen-18 and 110 parts per thousand in deuterium in the isolated branches of the northeast shore. However, the enrichment varies with time, as a function of the inflow conditions and the various climatic parameters, and affords a means of defining two areas of evolution in the lake. The influence of the evaporation enriched waters of the lake is very distinct in the fringe of groundwater near the shore but further inland it disappears. (Knapp-USGS)
W71-04387

PEOPLE EX REL CARLSTROM V HATCH (OWNERSHIP OF MARSH MEANDERED AS A LAKE).

350 Ill 586, 183 NE 610-613 (1932).

Descriptors: *Illinois, *Land tenure, *Prescrip rights, *Meanders, Real property, Navig waters, Lakes, Marshes, United States, S governments, Judicial decisions, Legal asp Land, Local governments, Governments.

Plaintiff state brought action against defendar possession to quiet title to marshland. The lan question had been surveyed and meandered navigable lake. However, no lake existed, and land was a marsh. Congress had conveyed marshland to the state, which had reconveyed the respective counties. Defendant claimed land by adverse possession against the cou Plaintiff contended that: (1) the United State establishing the meander, had ceded title to state in trust for the people, and (2) unlike against a county, a suit in adverse possession c not be maintained against the state. Observing the surveyor had no authority to fix a mea where no navigable lake existed, the Supr Court of Illinois held that title had passed unde conveyance of marsh lands to the state. Since fendant had established title by adverse possess title was held in defendant. (Hart-Florida)
W71-04438

A GEOLOGIC STUDY OF THE CHEMI QUALITY OF MEDICINE LAKE,
South Dakota Univ., Vermillon.
Merlin J. Tipton, and Richard G. Stockdale.
Available from NTIS as PB-197 529, $3.0 paper copy, $0.95 in microfiche. Completion port, South Dakota Water Resources Research stitute, January, 1971. 51 p, 2 tab, 7 fig, 16 r append. OWRR Project A-022-SDAK (1) an 022-SDAK (1).

Descriptors: Hydrologic aspects, Water qua *Evaporation, Chemical analysis, *Lakes, S ments, South Dakota, *Dissolved solids, Drai patterns (Geologic), *Drainage syst Geomorphology, Saline lakes.
Identifiers: *Medicine Lake (So Dak), *Cl drainage, Sediment cores.

Medicine Lake is a saline lake lying on the wes flank of the Coteau des Prairie in Codington C ty, SD. Total dissolved solids content ranges 35,000 parts per million to 65,000 parts per lion. The source of the salts entering Medi Lake is the result of 'normal' weathering of geo ic materials. The weathering products go into s tion with the groundwater, which is the prin source of recharge for Medicine Lake. Ver control data, supported by remote sensing the imagery, established Medicine Lake to be a cl drainage. Because evaporation exceeds preci tion large quantities of water are lost from closed drainage system. Groundwater moveme toward Medicine Lake from the southeast thro McKillicans Lake, Round Lake, and Horses Lake. Groundwater movement toward Medi Lake from the northwest is through a serie potholes. During the time groundwater is mo toward Medicine Lake it is exposed to evapora whenever it occupies one of the other lake ba As a consequence of this, concentration of the tial groundwater starts in McKillicans Lake progresses, with more evaporation and concen tion occurring, each time it is exposed in a basin. Medicine Lake, lying at the lowest eleva in the closed drainage system, receives gro water that has already been concentrated durin migration through the chain of lakes and poth Medicine Lake, because it is recharged by con trated groundwater, should, through more evap tion, contain the highest total dissolved solids tent which it does. The combination of a cl drainage system and a high rate of evapora seems to be the best explanation for the chem quality of the water in Medicien Lake.
W71-04517

APPLICATION OF THE THEORY OF GRA IN INVESTIGATION OF COMMUNITIES AQUATIC ORGANISMS, (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Ins Evolyutsionnoi Fiziologii i Biokhimii.

rimary bibliographic entry see Field 07B.
04522

TRIBUTION TO THE EPIPHYTIC ALGAL RA OF THE LAKE NEUSIEDLER, (IN GER-
a Univ. (Austria). Botanisches Institut und ischer Garten.
r Geitler.
reichische Botanische Zeitschrift, Vol 118, 2, p 17-29, 1970. 3 fig, 24 ref.

iptors: *Epiphytology, *Lakes, *Algae, Al- water, Magnesium, Sodium sulfates, phyta, Rhodophyta.
fiers: *Lake Neusiedler (Austria), aesiphon subaequalis, Apistonema expan- orphyridium griseum, Chrysotrichalae.

ed descriptions are given of the following pecies of algae revealed in the alkaline Lake dler: Chamaesiphon subaequalis of phyceae, Apistonema expansum of otrichalae, and Porphyridium griseum of phycea. The paper included a record of previously identified algae of the lake. -Wisconsin)
4526

ROLE OF ZOOPLANKTON IN THE OR- C MATTER DECOMPOSITION IN AN OPHIC LAKE, (IN RUSSIAN),
miya Nauk SSSR, Moscow. Institut Evolyut- Morfologii.
hcherbakov, and A. I. Ivanova.
l Obshchei Biologii, Vol 30, No 2, p 140- 969. 4 tab, 16 ref.

otors: *Lakes, *Zooplankton, *Decompos- ganic matter, *Oxygen, Eutrophication, gen sulfide, Copepods, Crustaceans, a, Rotifers, Protozoa, Predation.
ers: *Moscow region, Beloye Ozero), Gloobokoye Ozero (USSR), Vinberg ents.

bject of this study, the eutrophic Lake exhibits one peculiarity: its hypolimnion the stagnation period attains a critically high tration of hydrogen sulfide precluding the of zooplankters; consequently, the esti- of oxygen consumption by zooplankton in water were confined to the epilimnion. The diurnal consumption during the five warm was 0.37 mg/l, constituting 17% of the total ption of oxygen by biota of the lake. The were comparable with those obtained previ- investigations of the Lake Gloobokoye, in the same climatic region. In both water the predatory fraction of zooplankters con- about 25% of oxygen. (Wilde-Wisconsin)
-531

LOGICAL STUDIES ON THE OREGON . 1. WOAHINK LAKE,
State Univ., Corvallis. Dept. of Fisheries dlife.
W. Larson.
Resources Research Institute, Oregon State ity, Corvallis, WRRI-3, 1970. 40 p, 10 fig, 9 ref. OWRR Project A-003-ORE (2).

tors: *Lakes, *Limnology, Hydrologic Chemical properties, Crustaceans, s, Salmon, Bioassay, Water analysis, ankton, Zooplankton, Primary productivi-

rs: *Woahink Lake (Ore), Crater Lake Odell Lake (Ore), Waldo Lake (Ore), dredge sampler.

nology is documented of the recreationally ling Woahink Lake (Oregon). Investigated eristics of water included temperature, dis- xygen, pH, specific conductance, transmis- ncident radiation, dissolved solids, alkalini- ness, and contents of sodium, potassium, calcium, magnesium and zinc. The record of organisms includes representative genera of phytoplankton and the annual distribution of most important adult and juvenile members of zooplankton. Chlorophyll a, carbon dioxide, and primary productivity constituted other analyses. The results are compared with those obtained for three other Oregon lakes. The study was supplemented by a bioassay employing phosphorus, iron, nitrates, ammonia, and labeled sodium carbonate. (Wilde-Wisconsin)
W71-04536

BIOLOGICAL FIXATION AND TRANSFORMATION OF NITROGEN IN SMALL IMPOUNDMENTS,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
Dale W. Toetz.
Available from NTIS as PB-197 586, $3.00 in paper copy, $0.95 in microfiche. Oklahoma Water Resources Research Institute, Completion Report, July 1970. 34 p, 3 tab, 4 fig, 21 ref. OWRR Project No A-012-OKLA (1).

Descriptors: *Nitrogen fixation, Ammonia, Impoundments, *Ammonification, Nitrates, *Nitrification, Diel, Oklahoma, *Analytical techniques, Lakes, Ponds, Cyanophyta.
Identifiers: Acetylene reduction method, 15N technique, *Ceratophyllum, Nitrate assimilation, Ammonia nitrate, Ammonia assimilation, Diel assimilation.

Biological fixation and transformation of nitrogen was studied in impoundments in central Oklahoma using the acetylene reduction method and 15 N techniques. Nitrogenase activity, probably microbial, was detected in a small lake during the winter. This source was calculated to be only 1% of the quantity of N falling directly on the surface in precipitation. Nitrogen fixation was not detected in a highly eutrophic pond, nor was it detected in a large mainstream reservoir. In both heterocystis blue-green algae and nutrient depletion were never observed. Biological N fixation does not appear to be important in these waters. Transformation of nitrogen was studied in the small lake where nitrogen fixation was detected. A Ceratophyllum-periphyton community is large in biomass and dominates the flora. This community was found to be capable of continuous NH4 assimilation, but could assimilate NO3 most rapidly only in the light. An effort was made to learn if NH4 and NO3 assimilation by this community could be predicted from a knowledge of concentration. Uptake was linear with concentration but the effect of N starvation of the slope of the curve has not been explored.
W71-04544

LAKE HOURLY DISPERSION ESTIMATES FROM A RECORDING CURRENT METER,
Ontario Water Resources Commission, Toronto.
Merv D. Palmer, and J. Bryan Izatt.
Journal of Geophysical Research, Vol 76, No 3, p 688-693, January 20, 1971. 6 p, 3 fig, 4 tab, 18 ref. ONR Contract N00014-67-A-0103-0007, NR 307-252.

Descriptors: *Dispersion, *Water circulation, *Great Lakes, *Lake Erie, Currents (Water), Lakes, Mixing, Current meters, Path of pollutants, Tracking techniques, Correlation analysis, Probability, Markov processes, Stochastic processes, Reynolds number, Data collections, Statistical methods, Computer programs.
Identifiers: *Dispersion (Lakes).

For the Great Lakes, mean hourly dispersion coefficients are predicted by using a first-order Markov chain model developed from continuous hourly current meter records at a fixed point. Dispersion coefficients compare favorably with other studies. The Eulerian data are assumed equivalent to Lagrangian because the Reynolds numbers were large, and because the velocity field was homogeneous over the distances considered. A conventional dye injection study at Port Maitland on Lake Erie verified the conversion of data from Eulerian to Lagrangian form. Concentrations were computed as a function of distance for a constant continuous point source of a passive contaminant. A method was developed for determining the maximum, mean, and minimum probable distances traveled by a particle in a period of hours. (Knapp-USGS)
W71-04565

TRITIUM STUDY OF THE MIXING OF WATERS IN LAKES AND ESTUARIES, WITH PARTICULAR REFERENCE TO THE LAKE OF GENEVA AND THE GIRONDE (FRENCH),
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research.
M. Meybeck, P. Hubert, J. M. Martin, and Ph. Olive.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/32, p 523-541, 1970. 19 p, 9 fig, 4 tab, 13 ref.

Descriptors: *Tracers, *Tritium, *Mixing, *Lales, *Estuaries, Density stratification, Turbidity currents, Density currents, Water circulation, Water balance, Water sources, Diffusion, Dispersion, Stratified flow, Currents (Water).
Identifiers: *Lake Geneva, *Gironde.

Tritium was used as a tracer in a general study of the dynamics of the Lake of Geneva (Leman) and the Gironde in order to differentiate waters with identical physico-chemical characteristics. On the Lake of Geneva, tracers revealed a surface current, a main current at half depth and a turbidity current in a sublacustrine canyon. Three layers with their own well defined dynamic behavior (0-50 m, 50-150 m and 150-310 m) correspond to these movements. Only the surface layer may become homogeneous in winter. In the Gironde the use of tritium showed, in waters having identical or constant salinities, whether the fresh waters were of different fluvial origins. In this way a substantial difference in dynamic behavior and the absence of any significant exchanges between the edges and the center of the Gironde were found. In estuaries this method should permit the study of flood propagation and the formation of high-turbidity zones. (Knapp-USGS)
W71-04594

VERTICAL DENSITY CURRENTS--II,
Geological Survey, Washington, D.C.
W. H. Bradley.
Limnology and Oceanography, Vol 14, No 1, p 1-3, January 1969. 3 p, 2 fig, 3 ref.

Descriptors: *Density currents, *Laminar flow, *Dispersion, *Analytical techniques, Water properties, Air circulation, Density, Particle size, Technology, Application methods, Methodology, Hydrodynamics.
Identifiers: *Vertical flow, Virology, Mycology.

Examples of vertical density currents within the laminar flow domain, one in a water solution and the other in air, are presented. The examples illustrate new ways of introducing and dispersing microscopic particles into static fluids and demonstrate that a stable, clearly defined layer of dispersed particles forms first and that the vertical density currents originate and flow from the lower part of this layer. The new information comes from wholly unrelated lines of research, one in virology, and the other in mycology, but the information provides good experimental support in hydrodynamics. A mathematical approach can be used to develop the theory of vertical density currents so that the described observations can be applied to a broader spectrum of flow phenomena in air, water, and molten rock in the earth. (Lang-USGS)
W71-04606

MEASUREMENT AND ANALYSIS OF THE ANNUAL HEAT BUDGET FOR THE SEDIMENTS IN TWO WISCONSIN LAKES,
Dartmouth Coll., Hanover, N. H. Dept. of Biological Sciences, and Dartmouth Coll., Hanover, N. H. Dept. of Earth Sciences.
Gene E. Likens, and Noye M. Johnson.
Limnology and Oceanography, Vol 14, No 1, p 115-135, January 1969. 21 p, 13 fig, 5 tab, 25 ref. NSF Grant No GE-366.

Descriptors: *Heat budget, *Heat flow, *Lakes, *Bottom sediments, Bogs, Wisconsin, Thermocline, Marshes, Water temperature, Measurement, Instrumentation, Methodology.
Identifiers: *Stewart's Dark Lake (Wis.), Tub Lake (Wis.), Sediment temperatures.

Temperature was measured in the water, bottom sediments, and bog surrounding Stewart's Dark Lake and Tub Lake, Wisconsin, using a thermal probe to penetrate 8 m into the bottom material. In the deepest water of Stewart's Dark Lake, a steady state thermal gradient (0.20 deg C/m) was observed in the bottom sediments. Thermal conductivity of these gelatinous sediments was measured, and a steady-state heat flow value was derived. Isotherm patterns within these sediments and the bog demonstrate the importance of solar radiation and the effects of absorption and circulation in these lakes. Seasonal isotherm pattern changes are similar for both lakes. Temperature fluctuations are largely damped at depths below 4 m in the bogs. With respect to mean sediment temperature, each lake is surrounded by a relatively warm rim. The annual heat budget of sediments at the shoreline in Tub Lake is 3,670 cal/sq cm; at a water depth of 8 m, it is 70 cal/sq cm. The mean annual budget for the entire sediments of Stewart's Dark Lake is 730 cal/sq cm, and for Tub Lake is 970. These values are about 10 and 12%, respectively, of the total annual heat budgets for the water in each lake. (Lang-USGS)
W71-04608

CHEMICAL COMPOSITION AND PHYTOPLANKTON OF LAKES IN SOUTHERN ONTARIO,
Toronto Univ. (Ontario). Dept. of Botany.
J. H. Sparling, and C. Nalewajko.
Journal Fisheries Research Board of Canada, Vol 27, No 8, p 1405-1428, 1970. 10 fig, 4 tab, 34 ref.

Descriptors: *Water chemistry, *Phytoplankton, *Lakes, Geology, Ecotypes, Scenedesmus, Cultivated lands, Magnesium, Nutrients, Algae, Diatoms, Conductivity, Hydrogen ion concentration, Sodium, Potassium, Calcium, Chlorides, Bicarbonate, Electrolytes, Limestones, Cyanophyta, Chlorophyta, Chrysophyta.
Identifiers: *Southern Ontario (Canada), Specie associations.

Water chemistry in southern Ontario lakes is determined primarily by surface and bedrock geology and impact of cultivation. Total dissolved solids give a poor indication of electrolyte content of lakes, because of the varied geology. Four lake types are recognized: base-poor lakes (Precambrian shield), moderately base-rich lakes (Bancroft-Rideau lakes region) related to more easily weathered rocks, base-rich lakes (Limestone region south of shield receiving drainage from cultivated land), and base-rich lakes with high levels of magnesium (draining from Silurian dolomitic limestone bedrock and dolomite-rich glacial tills). Phytoplankton populations were partially related to the chemical composition of lake waters. Tabellaria flocculosa and to a lesser extent Asterionella formosa and Dinobryon divergens were associated mainly with base-poor lakes. A larger number of species, including Synedra acus, Pediastrum duplex, Scenedesmus quadricausa, Cyclotella meneghiniana, Synedra ulna, and Cyclotella kutzingiana, were significantly associated with base-rich conditions. An association diagram for all species found showed groupings, mostly of species that prefer base-rich conditions. Few species confined to base-poor lakes were found to form associations. Apparent associations between oligotrophic species and species known to prefer eutrophic lakes are explained by the fact that nutrients were depleted during survey. (Jones-Wisconsin)
W71-04618

PHYSICAL FACTORS WITH BEARING ON EUTROPHICATION IN LAKES IN GENERAL AND IN LARGE LAKES IN PARTICULAR,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
C. H. Mortimer.
Eutrophication: Causes, consequences, correctives. Printing and Publishing Office, National Academy of Sciences, Washington, D. C., p 340-368, 1969. 8 fig, 20 ref.

Descriptors: *Eutrophication, *Lakes, *Diffusion, Lake Michigan, Great Lakes, Hydrologic aspects, Oxidation-reduction potential, Temperature, Nutrients, Fluid mechanics, Activation energy, Stratification, Photosynthesis, Erosion, Iron, Coriolis force, Sediments, Manganese, Stratified flow, Hypolimnion, Epilimnion, Thermocline, Winds, Waves (Water), Currents (Water).
Identifiers: *Large lakes.

Dynamics of diffusion, of oxygen balance, and of nutrient gains and losses affect biological production in natural waters. Nutrient influx is influenced by rock weathering, soil formation, and in drainage basin soil processes. Whichever way the surface-sediment layer becomes reduced by diffusion the effects, especially on subthermocline water mass are profound and associated not only with reduction and mobilization of iron and manganese and the unlocking of adsorbed materials, but also with the resultant removal of a barrier to unimpeded diffusion across the sediment-water interface. Although supply variations from drainage basin are not without influence, iron and manganese core profiles reflect the control of redox conditions. If lake basin is long enough or wind distrubance great enough, part of the hypolimnion will be raised into contact with the atmosphere and oxygen will be distributed to subthermocline levels. Recent findings indicate that both the forced motions (wind-driven currents) and the free motions (internal waves) are characterized by dominance of shore-parallel, quasi-geostrophic flow near shore and by frequent occurrence of rotating (inertial or near-inertial) flow off shore; this combination may lead to partial or temporary separation of characteristic coastal and offshore water masses, resulting in entrapment of nutrients. (See also W70-03975) (Jones-Wisconsin)
W71-04620

LIMNOLOGICAL STUDIES ON LAKES IN THE DESCHUTES NATIONAL FOREST, OREGON. I. ODELL LAKE,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Douglas W. Larson.
Oregon State University, Corvallis, Water Resources Research Institute WRRI-4, 1970. 34 p, 9 fig, 9 tab, 21 ref. OWRR Project A-003-ORE (3).

Descriptors: *Limnology, *Lakes, *Oregon, Phytoplankton, Productivity, Temperature, Nutrients, Seasonal, Zooplankton, Sampling, Dissolved solids, Soils, Pumice, Eutrophication, Oligotrophy, Geology, Climatic data, Bathymetry, Hydrogen ion concentration, Depth, Conductivity, Optical properties, Alkalinity, Calcium, Magnesium, Potassium, Sodium Daphnia, Chlorophyta, Chrysophyta, Photosynthesis, Bioassay, Phosphorus, Iron, Nitrates, Ammonia.
Identifiers: *Deschutes National Forest (Ore), *Odell Lake (Ore), Crater Lake (Ore), Lapillus.

The limnology of Odell Lake is documented prior to substantial deterioration by recreation. Recorded are phytoplankton standing stock and primary production measurements (considered unusually high for an oligotrophic lake) and providing physical, chemical, and biological d establish a reference point for periodic estim of the effects of population impact. Temper light and nutrients appear to favor produc High production was sustained during summe fall, with algal blooms not uncommon; large ties of zooplankton were observed. Concent of total dissolved solids in Odell Lake was 1/3 of Crater Lake, yet, production in Odell was 8-10 times greater. Crater Lake contai elements comprising 75% of total dissolved suggesting that, although the value of tota solved solids is relatively high, certain essentia could be deficient. There is probably a b balanced supply of ions in Odell Lake with being deficient. The most salient feature of th profile was the large porosity and highly perm nature of the underlying pumiceous layers, th which subsurface water percolation woul rapid. Lake usage has increased resultin frequent pulses of phytoplankton and rela high rate of primary production. (Jones-Wi sin)
W71-04626

EUTROPHICATION IN LARGE LAKES IMPOUNDMENTS.

Uppsala Symposium, Sweden, May 1968. ganization for Economic Co-Operation Development, Paris, 1970. 560 p, 124 fig, 4 222 ref, 7 photos, 15 append.

Descriptors: *Eutrophication, *Lakes, *Wate lution control, Water pollution effects, Wate lution sources, Impoundments, Nutrients, P ties, Resources, Programs.
Identifiers: *Case studies, *OECD, Policies, P responsibility, Uppsala Symposium 1968, Scie research, Water management, Lake Mal Lough Neagh, Lake Maggiore, Lake Const Lake Lugano, Laurentian Great Lakes, Oslo F Morecambe Bay Barrage (Netherlands).

This attractively published 566 pp volume in glish and French covers the important aspects title. The synopsis of case studies, including Malaren, Lough Neagh, Maggiore, Const Laurentian Great Lakes, and Oslo Fjord, pre one of the best 'introductions' to the proble water eutrophication or pollution that is now fa the world. The section on research and man ment stresses that in the last analysis the 'eutro cation' or nutrient pollution is but one phase o problem of water quality, a problem complic by inert suspensions, poisons, reducing agents organic matter, hot water, radioactive substan and pathogenic organisms. The discussion of rent research and future needs provides a c prehensive review of urgent tasks and suggest for future action. The second part of the volum about 400 pp comprises detailed reports on lakes mentioned in case studies and also report Morecambe Bay Barrage, Lake Lugano, and poundments in the Netherlands. (See also W 04631 thru W71-04639) (Wilde-Wisconsin)
W71-04630

I. PRINCIPAL FEATURES IN THE CHEM TRY OF LAKE MALAREN,
Thorsten Ahl.
In: Eutrophication in large lakes and impou ments, Uppsala Symposium, Sweden, May 19 Organisation for Economic Co-Operation Development, Paris, 1970. p 169-195. 22 fig.

Descriptors: *Lakes, *Water pollution sour *Chemistry, Water pollution effects, Sampl Water properties, Watershed (Basins), Precip tion, Acids, Air pollution, Geology, Nutrients.
Identifiers: *OECD, *Uppsala Symposium 19 Lake Malaren (Sweden), Sulphuric a Hydrochloric acid, Nitric acid.

Malaren is one of the largest and most irregul shaped lakes of Sweden and presents a comple water basins of widely different chemical and bi

ıts. The detailed investigation of this lake was in 1964 following alarming deterioration of quality. The chemical analyses revealed a elationship between the degree of eutrophi- of different parts of the lake and geology of sin and location of population centers. No an bi-monthly sampling at 40.. stations pro- information on water temperature, trans- y, specific conductance, pH, and supply of ıts. A record of nutrients discharged from ant sub-watersheds, domestic sewage, and ial waste provided an estimate of the lake's t load. Recently, attention is given to acidifi- of precipitation, and, in turn, lake water by ic, nitric, and hydrochloric acids supplied e atmosphere by industry and agricultural ers. (See also W71-04630) (Wilde-Wiscon-

4631

IOLOGICAL SECTION,
rn Willen.
rophication in large lakes and impound- Uppsala Symposium, Sweden, May 1968. sation for Economic Co-Operation and pment, Paris, 1970. p 197-224. 25 fig.

tors: *Lakes, *Eutrophication, *Biological nities, Water pollution effects, Water pollu- rces, Nitrogen, Phosphorus, Pulp and paper , Physico-chemical properties.
ers: *OECD, *Uppsala Symposium 1968, Malaren (Sweden), Anabaena, ichia, Mercury.

cal investigations of Lake Malaren and its uting sources included determinations of , phytoplankton, C-14, chlorophyll, kton, and fish. As far as it was possible, al research was synchronized with physico- l analyses. Sharp differences were d in the local and seasonal distribution of ankton, bottom fauna, and fish. The density oplankton and content of chlorophyll were ed with the supply of nitrogen and rus. The catch of walleyed pike, pickerel, perch, and vendace varies locally from 2 to . Diagrams provide a comprehensive pic- biotic constituents in different sections of reflecting the distribution of pollution cen- e differences in the eutrophication level of bays are conspicuously revealed by of Gloeotrichia and Anabaena spp. Particu- tion is given recently to the inflow of mer- mpounds, discharged by paper industry, the appearance of 'black list' waters in ıe fish contains more than 1 mg mercury and is avoided as food. (See also W71- Wilde-Wisconsin)
632

NEAGH.

ophication in large lakes and impound- Uppsala Symposium, Sweden, May 1968. tion for Economic Co-Operation and ment, Paris, 1970. p 227-296. 12 tab, 13

ors: *Lakes, *Eutrophication, *Water pol- urces, *Water pollution effects, Biological ities, Algal poisoning, Cost/benefit ratio, reatment, Analytical techniques, Biology, Hydrology, Water pollution control.
s: *OECD, *Uppsala Symposium 1968, Neagh (Ireland), Algal blooms.

ort provides a large volume of analytical ecology, biology, hydrology, and pollution large, rather shallow, and definitely c lake of northern Ireland. Investigations rgest fresh water basin of the British Isles iated more than 50 years ago and assem- uch information on phytoplankton, ton, salmonoids, other fish, waterfowl, rmonid flies. The combined effects of ral, industrial, and airborn pollution from the watershed of about 4,500 sq km produced in 1967 extensive blooms that killed fish and precluded cattle from drinking water. Subsequent analyses revealed that the toxicity was due to blue-green alga Anabaena flos aquae, rather than a deficiency of oxygen. The cost/benefit ratio of ameliorations, possible toxicity of Anabaena to humans and animals, methods of treatment of sewage discharges, and control of algal blooms are the most pressing problems that confront the Government of Northern Ireland. (See also W71-04630) (Wilde-Wisconsin)
W71-04633

REPORT ON LAKE MAGGIORE,
G. Bonomi, M. Gerletti, E. Indri, and L. Tonolli.
In: Eutrophication in large lakes and impoundments, Uppsala Symposium, Sweden, May 1968. Organisation for Economic Co-Operation and Development, Paris, 1970. p 299-341. 10 fig, 9 tab, 207 ref.

Descriptors: *Lakes, *Eutrophication, *Water pollution sources, Water pollution effects, Political constraints.
Identifiers: *OECD, *Lake Maggiore, *Uppsala Symposium 1968, Algal blooms, Tabellaria fenestra, Oscillataria rubescens.

The geographic location destined the Lago Maggiore to serve as the final receptacle of domestic sewage and industrial discharges from 6600 sq km watershed of Italy and Switzerland. In spite of this, the average depth of 180 meters has thus far kept the concentrations of organic matter, nitrogen, and phosphorus near the oligotrophic-mesotrophic boundary. The fact that a large part of the drainage basin does not permit cultivation is an important contributing feature. The distribution of planktons in this 65 km long, but rather narrow lake is strongly influenced by the pattern of settlement, nature of tributary waters, and thermal characteristics. The estimates of primary productivity for the entire lake vary from 140 to 175 g carbon sq m/yr. The oxygen content in the deep layers is still satisfactory, but the blooms of Tabellaria fenestra and the first bloom of Oscillataria rubescens in 1967 are the 'alarm bells' of eutrophication. Also, infection of fish by bacteria, fungi, viruses, and tapeworms indicates the hazard of sewage pollution. While the distribution of oxygen and planktonic, benthic, and fish biocoenose provides an adequate record of the health conditions of the lake, the management of the system encounters engineering, social, and political difficulties. The latter may be particularly pronounced when the body of water is in the possession of two different States. (See also W71-04630) (Wilde-Wisconsin)
W71-04634

I. WATER QUALITY MAINTENANCE OF LAKE CONSTANCE.
International Water Protection Commission for Lake Constance.

In: Eutrophication in large lakes and impoundments, Uppsala Symposium, Sweden, May 1968. Organisation for Economic Co-Operation and Development, Paris 1970. p 345-357. 5 fig.

Descriptors: *Lakes, *Eutrophication, *Water pollution sources, *Water pollution effects, International commissions, Water quality control, Sewage treatment.
Identifiers: *Lake Constance, *OECD, *Uppsala Symposium 1968, Germany, Austria, Switzerland.

The Obersee-Untersee twins of Lake Constance serve as storage basins for waters contributed by the uplands of Germany, Austria, and Switzerland. Unfortunately, aside from water, the lake receives sewage and wastewater of the shore communities of the three Republics. The state of eutrophication of different parts of the lake is instructively illustrated by a color map showing four degrees of pollution. The deterioration of water quality threatens the survival of the 'Felchen,' a salmonid of an exceptionally delicate taste, and other fish totaling 4,000 ton annual catch. Following prolonged negotiations, in 1960 the three bordering states signed an international agreement of anti-pollution measures, an act which alone can promise success of water protection. The experts of the International Commission for Lake Constance digested the results of previous investigations and greatly enlarged the scope of research. The results of analyses indicated that the sewage phosphorus is the main cause of the biological deterioration of the lake. In consequence, a diversified program of sewage purification is now in the state of progressive materialization. (See also W71-04630) (Wilde-Wisconsin)
W71-04635

LAKES AND IMPOUNDMENTS IN THE NETHERLANDS.

In: Eutrophication in large lakes and impoundments, Uppsala Symposium, Sweden, May 1968. Organisation for Economic Co-Operation and Development, Paris, 1970. p 555-560.

Descriptors: *Lakes, *Canals, *Eutrophication, Water management (Applied), Water pollution effects, Water pollution control, Fish, Reaeration, Potable water, Desalination, Water purification, Artificial recharge, Groundwater recharge, Water storage.
Identifiers: *OECD, *Uppsala Symposium 1968, Boezems, Holland.

The 'boezems' of interconnected canals and lakes form the unique artificially controlled water system of Holland. The water levels in these networks are maintained by sluices and powerful pumping stations. Continuous flushing is used to reduce pollution and salt content of brackish seepage. Flushing with fresh water of IJssellake and Rhine decreases the salinity of the boezems, but not the degree of water eutrophication; IJssellake receives an enormous input of phosphorus and the Rhine is loaded with nutrients. In turn, the growth and blooms of Asterionella formosa, Anabaena spiroidia, and other algae hinder fish life and recreational activities, and require intensive purification of water for either drinking or industrial purposes. Improvement in the supply and quality of water is sought in artificial recharge of groundwater and storage of surface water in large reservoirs. Some isolated sand and gravel borrow-pits preserve water of excellent quality. Recent trials demonstrated that air-bubble injections raise deep saline water and alleviate anaerobic conditions of hypolimnia. (See also W71-04630) (Wilde-Wisconsin)
W71-04636

THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES; A PROGRAM OF SYNOPTIC STUDIES OF A LARGE LAKE,
L. A. Heindl, and I. C. Brown.
In: Eutrophication in large lakes and impoundments, Uppsala Symposium, Sweden, May 1968. Organisation for Economic Co-Operation and Development, Paris, 1970. p 383-389. 1 tab.

Descriptors: *Lakes, *International Hydrological Decade, *Lake Ontario, Synoptic analyses, Hydrologic aspects, Meteorological data, Water balance, Heat balance, Water circulation, International commission, Foreign countries, Standards, Data collections.
Identifiers: *OECD, *Uppsala Symposium 1968, IFYGL.

In the early 60's hydrologists all over the world came to realize the crucial need for information on the quality of natural waters and management of water resources. Nearly 100 nations banded together in a 10-year program of hydrological research, designated as the International Hydrological Decade. The IHD found strong support in the USA and Canada, and the first joint effort of the two countries found its expression in the International Field Year for the Great Lakes (IFYGL).

The proposed field year activity is to be confined to the Lake Ontario, its meteorology, terrestrial water balance, heat balance, and water movement. Analyses and preparation of reports would be extended through 1973. The Steering Committee will provide direction to the program, and operational coordination will be effected by specialists employed by the Inland Water Branch of Canada and U S Corps of Engineers. The operational procedure in each country, however, will be in accord with their practices. (See also W71-04630) (Wilde-Wisconsin)
W71-04637

THE EUTROPHICATION OF LAKE MICHIGAN,
John C. Ayers.
In: Eutrophication in large lakes and impoundments, Uppsala Symposium, Sweden, May 1968. Organisation for Economic Co-Operation and Development, Paris, 1970. p 399-408. 7 tab, 15 ref.

Descriptors: *Lakes, *Lake Michigan, *Eutrophication, Water pollution effects, Dissolved solids, Nitrogen, Phosphorus, Fish, Algae, Lampreys, Calcium carbonate, Winds, Mixing, Thermal stratification, Thermocline, Isotherms.
Identifiers: *OECD, *Uppsala Symposium 1968, Algal blooms, Cladophora, Alewife, Milky water, Thermal bar.

The eutrophication of Lake Michigan is probably most strongly pronounced in the vicinity of Chicago. In this region, the content of total dissolved solids has risen during the past 75 years from 130 to 170 ppm. Nitrogen and phosphorus concentrations have now reached the nuisance-algae-bloom level. Since 1926 the phytoplankton increased annually at a rate of 13 organisms per millimeter. Recently Cladophora polluted 6 public beaches. The records of fish and zooplankton were distorted by immigrant species, such as sea lamprey and alewife. The main body of Lake Michigan is not easily assessed, but studies of the last 40 years revealed significant changes in zooplankton, formation of marl in epilimnion, increased turbidity, and a reduction in hypolimnic oxygen. In recent years, formation of calcium carbonate crystals produced milky water color which very likely reduces the depth of the euphotic zone and diminishes the content of near-bottom oxygen. The distribution of the inshore pollutants through the main body of the lake is accomplished largely by winter wind mixing and migration of the 'thermal bar,' the spring equalization of water masses having temperature above and below 4 degree C. The waters injected into the main body epilimnion by rotation of 4 degree isotherm support high phytoplankton and produce blooms after the thermal stratification is completed. (See also W71-04630) (Wilde-Wisconsin)
W71-04638

RECENT DEVELOPMENTS AND PRESENT-DAY SITUATION IN RELATION TO THE LAKE OF LUGANO AND ITS TRIBUTARIES,
Otto Jaag, and Erwin Marki.
In: Eutrophication in large lakes and impoundments, Uppsala Symposium, Sweden, May 1968. Organisation for Economic Co-Operation and Development, Paris, 1970. p 533-551. 13 fig, 4 tab.

Descriptors: *Lakes, *Eutrophication, Water pollution effects, Water pollution sources, Water pollution control, Fishkill, Fish harvests, Sewage, Industrial wastes, Sewage treatment.
Identifiers: *OECD, *Uppsala Symposium 1968, Oscillatoria rubescens.

The two-thirds Swiss and one-third Italian Lake Lugano exhibited symptoms of malady as early as 1889, the year of the first dramatic fish kill. Investigations during the past 20 years were largely conducted in response to the progressively declining fish harvests. Research revealed one of the reasons for the biological deterioration of the lake is a continuous reduction in the hypolimnic oxygen concentration. The average oxygen content at the end of summer stagnation at a depth of 50 m had decreased from 7.4 mg/l in 1946 to 4.1 mg/l in 1964. The unfavorable alteration in the chemical composition of the lake is attributed to the inflow of domestic sewage and industrial waste water that induced lush development of Oscillatoria rubescens. Some improvement in water quality is expected following the construction of a purification sewage plant for the City of Lugano. (Wilde-Wisconsin)
W71-04639

LIMNOLOGY OF TWO RE-REGULATION RESERVOIRS IN SZECHOSLOVAKIA,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
Milan Straskraba, and Pavel Javornicky.
Typescript. 69 p, 34 fig.

Descriptors: *Limnology, Reservoirs, Hydrologic aspects, Biological properties, Epilimnion, Temperature, Energy, Surface waters, Water temperature, Mathematical models, Phytoplankton, Zooplankton, Photosynthesis, Chlorophyll, Primary productivity, Oxygen.

An empirical model of annual temperature cycles is developed for Vltava Cascade Reservoirs. During a two year study and evaluation of 10 years of data the temperature change within the poorly stratified water body of the re-regulation reservoir, fed from the hypolimnion of the power - generation reservoir, was found to correlate well with the air - water temperature gradient and retention time. A second order sine curve proved to express adequately the annual temperature cycles within the Cascade reservoirs. The species composition, abundance and standing crop of phyto-and zooplankton, as well as the chlorophyll-a content and photosynthetic activity of phytoplankton, are explained for the conditions of the reservoirs. The upper reservoir resembles arctic lakes as to phytoplankton activity. (Novotny-Vanderbilt)
W71-04717

SOME MICROBIAL-CHEMICAL INTERACTIONS AS SYSTEMS PARAMETERS IN LAKE ERIE,
Ohio State Univ., Columbus. Microbial and Cellular Biology.
For primary bibliographic entry see Field 06A.
W71-04758

DEVELOPMENT OF AN OXYGEN-BASED PERFORMANCE MODEL FOR THE WESTERN LAKE ERIE PHYSICO-BIOLOGICAL SYSTEM,
Ohio State Univ., Columbus. Dept. of Microbiology.
For primary bibliographic entry see Field 06A.
W71-04759

PRELIMINARY POLICY MODELS FOR GREAT LAKES REGULATION,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
For primary bibliographic entry see Field 06A.
W71-04760

ECOLOGICAL MODELING RESEARCH IN THE GREAT LAKES,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries; and Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-04780

2I. Water in Plants

VASCULAR AQUATIC PLANTS IN ACID MI WATER OF THE MONONGAHE RIVER,WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Resea Inst.
For primary bibliographic entry see Field 05C.
W71-04418

2J. Erosion and Sedimentation

SURF-BEAT ORIGIN FOR PULSATING BO TOM CURRENTS IN THE RIO BALSAS SU MARINE CANYON, MEXICO,
Geological Survey, Menlo Park, Calif.
Erk Reimnitz.
Geological Society of America Bulletin, Vol 82, 1, p 81-89, January 1971. 9 p, 5 fig, 10 ref.

Descriptors: *Surf, *Erosion, *Rip curre *Ocean waves, *Canyons, Estuaries, Rivers, S ment transport, Bed load, Channels, Streamfl Currents (Water).
Identifiers: *Surf-beat current pulses, *Subma canyons, *Mexico.

At the head of a tributary to the Rio Balsas s marine canyon system in Mexico, during a per of large surf, river discharge deflected a pulsat longshore current (peaking at over 7 km/ seaward over the tributary heading in the surf zo This pulsating flow occasionally entered the ri mouth, causing rhythmic fluctuations with a plitudes of at least 30 cm and a period of abou minutes within the mouth, as recorded by a p tially filtered tide gage. Current pulses with e mated velocities of 4 km/hr transport la amounts of suspended sand down an axial slope 26 deg. This bottom flow was at least 3 m thick, was characterized by pulses separated by q periods in phase with the surface rip current. E mated water budget suggested that the entire wa column below the rip current at 18 m was not fl ing seaward during the pulses. The magnitude the flow was sufficient to erode the canyon wa These observations substantiate that rip curre play a role in the formation of some submar canyons. (Knapp-USGS)
W71-04352

AN EVALUATION OF PROCEDURES USED COMPUTING CHEMICAL DENUDATI RATES,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
W71-04353

COASTAL LANDFORMS: CRESCENTIC A RHYTHMIC,
Virginia Univ., Charlottesville.
Robert Dolan.
Geological Society of America Bulletin, Vol 82, 1, p 177-180, January 1971. 4 p, 4 fig, 14 ref.

Descriptors: *Beaches, *Sediment transpo *Sand waves, *Beach erosion, North Caroli Geomorphology, Currents (Water), Rip curren Coasts, Dunes, Littoral drift, Surf, Waves (Wate Storms.
Identifiers: *Coastal landforms.

Crescentic shoreline landforms are common alo many sandy coasts. Some of these migrati rhythmic forms reflect interacting processes a systematic bar-and-trough configurations wit the surf zone. The rate of migration along the co is greater during the stormy winter season. The forms must be better understood for more efficie engineering and experimental design. (Knap USGS)
W71-04354

FRESH WATER IRON-MANGANESE NODULES N LAKE GEORGE, NEW YORK,
Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-04355

MECHANICAL COMPACTION OF SANDS CONTAINING DIFFERENT PERCENTAGES OF DUCTILE GRAINS: A THEORETICAL APROACH,
Shell Oil Co., Houston, Tex.
For primary bibliographic entry see Field 02F.
W71-04360

STIMATION OF BASIC CHARACTERISTICS F MUDFLOWS ('SEL'),
akavkazskii Nauchno-Issledovatelskii idrometeorologicheskii Institut, Tiflis (USSR).
I. Kherkheulidze.
: Floods and Their Computation, Vol 2, Internaonal Association of Scientific Hydrology Publicaon No 85 (Unesco-WMO), p 940-948, 1969. 9 p, tab, 9 ref.

escriptors: *Mudflows, *Sediment transport, Rainfall-runoff relationships, Storm runoff, Open annel flow, Mud, Sediment load.
entifiers: USSR, Sels.

method for estimation of maximum discharge d volumes of liquid and solid mudflows (sel) is scussed. The volume of the sel may greatly exed the volume of the initial rainfall or snowmelt noff, depending upon the degree of porosity and eliminary water saturation of friable soils on the tershed. The possible limits of solid content of e sel are discussed, giving as characteristic exames two watersheds in the Alps and a watershed in e Caucasus. The relationships of the maximum d mean velocity of sels and their width, depth d total static and dynamic pressure on obstacles e given. The proposed relationships result from mentary analysis of the two-phase soil and water tem and from correlation analysis of 40 actual asurements. Maximum velocities of sels ranged m 14.0 to 22.0 m/sec., volumetric weight from 7 to 2.29 t/cu m, mean stream depth from 0.10 11.2 m and longitudinal channel slope from 3.8 26%. (Knapp-USGS)
71-04415

CENT VARIATIONS IN COURSE AND GIMEN, KANSAS RIVER AND NEARBY ACHES OF MISSOURI RIVER,
nsas Water Resources Research Inst., Manhat-
.
kefield Dort, Jr., and John R. Ratzlaff.
ailable from NTIS as PB-197 593, $3.00 in er copy, $0.95 in microfiche. Completion Re-t, Kansas Water Resources Research Institute, nhattan, Contribution No 50, (1970). 51 p, 10 8 fig, 51 ref, append. OWRR Project No A--KAN (1).

criptors: *Erosion, *Sediment load, Sedimenta-, Sediments, *Channel morphology, Stream ion, Precipitation, Discharge measurement.
ntifiers: Channel patterns, Cultivation, Stream harge, *Kansas River, *Missouri River.

nges in stream morphology can be deteristic (alterations of variables within the physical em by climatic or cultural influences and efs) or probabilistic (random processes). It may difficult or impossible to isolate and identify cific cause and effect relationships. Evaluation hanges in channel pattern and sinuosity of the sas River involves the selection of data of apriate quantity and quality. Data for channel ern and stream discharge, which constitute an irically-derived functional relationship, best t the requirements. Stream discharge, through ssociation with precipitation, is investigated on ne scale of several decades. Annual discharge re these measurements were recorded is estimated indirectly from annual precipitation computed as a representative figure for the entire drainage basin. Settlement and cultivation accelerated erosion and resulted in increased sediment loads supplied to the river. The significance of this change is discussed along with other possible factors. The channel lengths and gradients upstream and downstream from the study area are studied. An interpretation of the configuration and behavior of the river prior to 1950 is presented.
W71-04542

ESTIMATING SUSPENDED SEDIMENT CONCENTRATIONS IN STREAMS BY TURBIDITY MEASUREMENTS,
Agricultural Research Service, Danville, Vt.; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 07B.
W71-04560

BIOTURBATION OF SEDIMENTS IN A NORTHERN TEMPERATE ESTUARY,
Chicago Univ., Ill. Dept. of the Geophysical Sciences; New Hampshire Univ., Durham. Jackson Estuarine Lab.; and New Hampshire Univ., Durham. Dept. of Earth Sciences.
For primary bibliographic entry see Field 02L.
W71-04561

RATES AND MODES OF DENUDATION, WHITE MOUNTAINS, EASTERN CALIFORNIA,
Bucknell Univ., Lewisburg, Pa. Dept. of Geology and Geography; and Geological Survey, Washington, D.C.
Denis E. Marchand.
American Journal of Science, Vol 270, No 2, p 109-135, February 1971. 27 p, 7 fig, 8 tab, 33 ref.

Descriptors: *Erosion, *Weathering, *Leaching, *California, Stream erosion, Sheet erosion, Geomorphology, Hydrogeology, Geochemistry, Water chemistry, Vegetation effects.
Identifiers: *Erosion rates, *White Mountains (Calif).

Long-term total erosion rates in the White Mountains, estimated from depths of removal beneath a 10.8-m.y.-old basalt, range from 1 to 3 cm per 1000 years. Present rates of chemical denudation, corrected for contributions from the atmosphere and biosphere, are 0.14 to 0.19 cm per 1000 years in dominantly adamellite terrain and 1.7 to 2.1 cm per 1000 years in areas underlain by Reed Dolomite. These figures are much lower than Reed Dolomite denudation rates estimated from botanical evidence in the same area (LaMarche, 1968) but are consistent with erosion rates in the nearby Sierra Nevada. Chemical denudation by plant uptake and litter erosion was evaluated and compared with removal in solution. Although total amounts of biogeochemical erosion do not appear to be significant, this process may account for some part of the extraction of P and K and is apparently responsible for appreciable portions of Al, Fe, and Mn denudation. In stream waters draining dolomite, partial pressures of CO2 exceed values for air and adamellite-derived waters by over an order of magnitude. These differences are ascribed to biological factors rather than to solution of carbonate minerals. (Knapp-USGS)
W71-04562

MASS PHYSICAL PROPERTIES AND SLOPE STABILITY OF SEDIMENTS OF THE NORTHERN MIDDLE AMERICA TRENCH,
Woods Hole Oceanographic Institution, Mass.
David A. Ross.
Journal of Geophysical Research, Vol 76, No 3, p 704-712, January 20, 1971. 9 p, 7 fig, 31 ref. ONR Contract N00014-66-C-0241.

Descriptors: *Bottom sediments, *Physical properties, *Slope stability, *Continental shelf, Pacific Ocean, Clay minerals, Particle size, Moisture content, Sampling, Clays, Silts, Porosity, Shear strength, Density, Cores.
Identifiers: Middle America Trench.

The mass physical properties (shear strength, porosity, and density) of 32 cores from the northern part of the Middle America Trench have been determined. A stability analysis using the shear strength data (determinations made with a vane shear device) indicate that the sediments are generally stable except on the landward flank of the trench where slumping is possible under the slope conditions observed. Comparisons of gravity-piston core pairs indicate differences in porosity and shear strength that are the result of the coring procedure. The corer used in this study was designed to minimize sample disturbance, but better coring devices are needed before in situ conditions are approached. Porosity and the log of shear strength are inversely related, and porosity has a positive relationship to clay content. The specific gravity of the sediments is 2.66 gm/cc (at zero proosity), a value similar to that of other areas with a high rate of terrigenous deposition. (Knapp-USGS)
W71-04566

THE MECHANICS OF SAND TRANSPORT ON BEACHES,
Scripps Institution of Oceanography, La Jolla, Calif.
Paul d. Komar.
Journal of Geophysical Research, Vol 76, No 3, p 713-721, January 20, 1971. 9 p, 3 fig, 14 ref.

Descriptors: *Sediment transport, *Beaches, *Littoral drift, *Ocean waves, Ocean currents, Shores, Waves (Water), Sands.
Identifiers: Beach sediment transport.

On steep-faced beaches where waves break and swash at an angle to the shoreline, the littoral drift of beach material results from the saw-tooth motions of the sediment in the longshore direction. The sand moves forward obliquely to the shore under the incoming wave swash and then moves normal to the shoreline under the return flow. For such transport conditions a rational derivation leads to a relationship using a function of the angle the breaking wave makes with the shoreline. This often applied relationship, previously only intuitive, is rigorously established for special saw-tooth transport and applies also when the sediment is transported by a longshore current proportional to the orbital velocity under the breaking waves. These are the two most important mechanisms by which sediment is transported along the shore under wave action. The profiles of variation of the longshore sand transport as a function of the distance seward of the swash line are examined theoretically. The results conform with the field observations. (Knapp-USGS)
W71-04567

STOCHASTIC MODEL FOR SAND DISPERSION,
Illinois Univ., Urbana. Water Resources Center; Illinois State Water Survey, Urbana; and Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
Chih Ted Yang, and William W. Sayre.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY2, Paper 7892, p 265-288, February 1971. 24 p, 16 fig, 2 tab, 10 ref, append.

Descriptors: *Sediment transport, *Mathematical models, *Stochastic processes, *Dispersion, Open channel flow, Model studies, Hydraulic models, Statistical methods, Probability, Channel morphology, Sedimentary structures, Bed load.
Identifiers: Sand dispersion.

The movement of sand particles is expressed in terms of steps and rest periods. The longitudinal dispersion of sand particles along the bed of an alluvial channel is formulated in a general one-dimensional stochastic model. Three different methods are suggested for determining the three parameters in the stochastic model. Experimental

results indicate that the step lengths follow a gamma distribution and that the rest periods follow an exponential distribution. Statistical analysis of bed configuration indicates the movement of sand particles along an alluvial bed should be closely related to the statistical properties of the bed configuration. The results of longitudinal dispersion experiments compare favorably with predications based on the stochastic model. (Knapp-USGS)
W71-04573

SABELLARIA REEF MASSES IN DELAWARE BAY,
Delaware Univ., Newark. Dept. of Biological Sciences; and Delaware Univ., Newark. Marine Lab.
For primary bibliographic entry see Field 02L.
W71-04588

PORTABLE RADIOISOTOPE GAUGES FOR SUSPENDED SEDIMENTS,
International Atomic Energy Agency, Vienna (Austria).
T. Florkowski.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/34, p 545-554, 1970. 10 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Sediment load, *Suspended load, *Nuclear meters, *Gamma rays, Instrumentation, Calibrations, Radioactivity techniques, Soil density probes, Sedimentation, Sediment transport.
Identifiers: *Nuclear sediment meters, *Gamma backscatter probes.

A new type of gage for measurement of suspended sediments is described. A gage with a Am-241 radioisotope source used attenuation of scattered gamma photons as a measure of sediment concentration. A theoretical and semi-empirical approach to the design of the instrument is discussed, including the influence of chemical composition of the sediment. A practical method for correcting a laboratory made calibration curve for the changes of chemical composition of the sediment is proposed for the new probe and for the absorption-type Cd-109 probe. Field tests of the probes in different conditions are evaluated. (Knapp-USGS)
W71-04595

TURBIDIMETRY: MEASUREMENT OF X- OR GAMMA-ABSORPTION OR MEASUREMENT OF NATURAL RADIOACTIVITY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
G. Courtois, F. Anguenot, and C. Magloire.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/35, p 555-580, 1970. 26 p, 11 fig, 2 tab, 8 ref.

Descriptors: *Sediment load, *Suspended load, *Nuclear meters, *Gamma rays, Instrumentation, Calibrations, Radioactivity techniques, Soil density probes, Sedimentation, Sediment transport, Clays, Silts.
Identifiers: *Nuclear sediment meters, *Gamma-ray probes.

Turbidity may be measured by radioactive means on the basis of the two following methods: (a) measurement of gamma absorption in a nuclear gage, corresponding to a measurement of the density of the medium; (b) in-situ measurement of the natural radioactivity of the sediment in suspension. The two methods were evaluated simultaneously by using a gamma absorption gage (Am-241) and by carrying out in-situ measurements of natural radioactivity of sediment in suspension. The advantages and disadvantages of each of these two methods are critically analyzed. It would appear, in particular that the natural radioactivity gage is much less sensitive to local salinity and is a valuable tool in estuaries of variable salinity and of generally high turbidity, and that being stronger and simpler, it is less sensitive to different parameters (electronic drifts, geometric variations, etc). On the other hand, it must be calibrated for each site and periodically on the same site. Further, it can only be used in a clayey medium. Particulars are given for the use of each of these instruments. (Knapp-USGS)
W71-04596

THE MASS OF LABELLED INJECTION SEDIMENTS FOR USE IN A RADIOACTIVE TRACER EXPERIMENT IN DYNAMIC SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
G. Courtois, and G. Sauzay.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/36, p 581-616, 1970. 36 p, 19 fig, 4 ref.

Descriptors: *Sediment transport, *Bed load, *Tracking techniques, *Tracers, *Tagging, Instrumentation, Nuclear meters, Radioactivity techniques, Sands.
Identifiers: *Bed load tracers.

A general theory is given of detector response variation and of the probability associated with each value of that response when the number and distribution of the radioactive sources in a given volume vary while the activity remains constant. The theory is applied to the problem of detecting a cloud of tracers in sedimentology experiments. First, the calculation is made with a tracer distributed at the surface of the bed for a sand of uniform grain size and for a given detector of known geometric response. Static detection of the cloud and then a dynamic detection (probe pulled along the bed) were studied. In both cases the minimum mass of tracer per unit of activity which has to be immersed in order to obtain a fluctuation in the count-rate due to the change in position of the radioactive grains, equivalent to 30% of the mean count-rate were determined. General formulae take these parameters into account and can be used for determining the quantities of sand for immersion as a function of the measurement parameters and of the characteristics of the sediment. Dynamic detection requires a quantity of tracer per unit ten times smaller than for static detection, the latter in turn requiring ten times less tracer than a core-sampling analysis. (Knapp-USGS)
W71-04597

2K. Chemical Processes

AN EVALUATION OF PROCEDURES USED IN COMPUTING CHEMICAL DENUDATION RATES,
Geological Survey, Menlo Park, Calif.
Richard J. Janda.
Geological Society of America Bulletin, Vol 82, No 1, p 67-79, January 1971.13 p, 1 fig, 2 tab, 47 ref.

Descriptors: *Weathering, *Erosion, *Solutes, *Dissolved solids, Leaching, Water pollution effects, Erosion, Bicarbonates, Sulfates, Chlorides, Nitrates, Silica.
Identifiers: *Chemical denudation, *Erosion (Chemical).

Computations of chemical denudation rates should be based only upon those components of dissolved loads of streams that are derived from chemical weathering of rocks and soils, even though identification of those components is difficult and imprecise. Past computations of chemical denudation rates exaggerated by 1.4 to 2.4 times the significance of this process because they were calculated from total dissolved loads. In crystalline s
icate rock terrane, commonly 25 to 55% of the di
solved solids are HCO3, SO4, Cl and NO3, th
cannot be derived from the underlying rock; i
stead these ions are derived either directly from t
atmosphere or from atmosphere-biosphere intera
tions. Atmospheric contributions to dissolved loa
of dilute natural waters are substantial. Concentr
tion of natural solutes represents a modification
natural denudation processes that does not chan
the rate of denudation. Addition of new solut
represents man-induced, accelerated chemic
denudation. (Knapp-USGS)
W71-04353

FRESH WATER IRON-MANGANESE NODULE IN LAKE GEORGE, NEW YORK,
Rensselaer Polytechnic Inst., Troy, N. Y. Dept.
Geology.
Manfred Schoettle, and Gerald M. Friedman.
Geological Society of America Bulletin, Vol 82, N 1, p 101-109, January 1971. 9 p, 10 fig, 2 tab, 3 ref.

Descriptors: *Sedimentation, *Manganese *Lakes, *New York, *Chemical precipitatio Water chemistry, Mineralogy, Iron, Bottom sed ments, X-ray analysis, Geochemistry.
Identifiers: *Manganese nodules, *Lake Georg (NY).

Lake George, New York, is the site of a ne discovery of iron-manganese nodules. Thes nodules occur at a water depth between 21 and 3 m along a stretch of lake extending for about 5 n north and south of the Narrows, a constricte island-dotted area which separates the north an south Lake George basins. Nodules occur on within the uppermost 5 cm of a varved glacial cla The Lake George nodules are enriched in iron wit respect to marine nodules but are lower in mar ganese. They have a higher trace element concen tration than nodules from other known freshwate lake occurrences, but a lower concentration tha marine nodules. (Knapp-USGS)
W71-04355

ADSORPTION OF ISOCIL AND BROMACI FROM AQUEOUS SOLUTION ONTO SOM MINERAL SURFACES,
Oregon State Univ., Corvallis. Dept. of Agricul tural Chemistry; and Oregon State Univ., Corvallis Environmental Health Sciences Center.
For primary bibliographic entry see Field 05B.
W71-04356

ESTIMATION OF ADSORBABLE SOLUTES I SEAWATER WITH C-LABELLED PHENO AND ACTIVATED CARBON,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05A.
W71-04357

CONTINUOUS EXTRACTION OF ORGANIC MATERIALS FROM WATER,
Geological Survey, Denver, Colo; and Federa Water Quality Administration, Edison, N.J.
For primary bibliographic entry see Field 05A.
W71-04358

CHEMICAL QUALITY OF MICHIGAN STREAMS,
Geological Survey, Washington, D.C.
Warren W. Wood.
Geological Survey Circular 634, 1970. 21 p, 12 fig, 1 tab, 20 ref.

Descriptors: *Water quality, *Surface waters, *Michigan, *Hydrologic data, *Data collections, Streams, Chemical analysis, On-site tests, Laboratory tests, Water resources development, Streamflow, Discharge measurement, Water temperature, Geology, Geochemistry, Water chemistry, Water pollution sources.
Identifiers: *Michigan streams (Chemical quality).

o aid in defining the chemical quality of stream aters in Michigan, samples were collected at ap-roximately 200 gaging stations. One series of sam-es was collected in late March and early April 967 when streamflow was high. The second set as collected in late August and early September 967 under conditions of low streamflow. All mea-red parameters illustrate distinct regional pat-ms of distribution that shift only slightly under nditions of high and low flow. Water in the reams is of the calcium magnesium bicarbonate pe and remains this type under high- and low-w conditions. Concentrations of dissolved sub-ances are generally lower during periods of high w than during periods of low flow. The higher ncentrations that occasionally occur at spring gh flows are attributed to inflow of water from mbination of effluent from sewers, fertilizers, d possibly road salt. Considering all parameters, ere is a distinct tendency for the most dilute ater to appear in the northern peninsula. Woodard-USGA)
71-04362

LTY GROUNDWATER IN THE POCATAL-O RIVER BASIN,
eological Survey, Morgantown, W.Va.
r primary bibliographic entry see Field 05B.
71-04368

OMIDE AND IODIDE IN OILFIELD BRINES SOME TERTIARY AND CRETACEOUS FOR-ATIONS IN MISSISSIPPI AND ALABAMA,
reau of Mines, Bartlesville, Okla. Bartlesville troleum Research Center.
r primary bibliographic entry see Field 02F.
71-04417

NJUGATED ADDITIONS IN HYDROGEN UORIDE, (IN GERMAN),
ademiya Nauk SSR, Moscow. Institut Elemen-rganicheskikh Soedinenii.
S. German, and I. L. Knunyantz.
gewandte Chemie, Vol 81, No 9, p 321-328, 68. 48 ref.

scriptors: *Water properties, *Chemical reac-ns, *Chemical properties, *Halogens, Ethers, ohols.
ntifiers: *Hydrogen fluoride, Conjugated addi-ns, Secondary reactions, Esters, Beta-fluoral-ol, Oxonium ions, Hypofluoridation.

entering into a reaction with CC-double bond, water-free hydrogen fluoride can give rise to ny new compounds, such as alpha-fluoride, a-halogen, beta-alkyl, beta- nitro- and beta-ino compounds. The secondary reactions may duce fluorized ether, alcohol, ester, and car-ic acids. The 'hypofluoridation' in the presence oxonium ions may yield beta-fluoralcohol. ilde-Wisconsin)
71-04525

DIOACTIVITY IN CALIFORNIA WATERS LY-DECEMBER 1968.
ifornia State Dept. of Public Health, Berkeley. reau of Radiological Health.
primary bibliographic entry see Field 05B.
1-04530

MPORAL DISTRIBUTIONS OF RADIOAC-VITY AND Sr-89/Sr-90 RATIOS DURING INSTORMS,
ansas Univ., Fayetteville. Dept. of Chemistry.
primary bibliographic entry see Field 02B.
1-04563

EP-SEA IN SITU CALCIUM CARBONATE TUROMETRY,
ifornia Univ., Los Angeles. Dept. of Geology; California Univ., Los Angeles. Geophysics and netary Physics.
primary bibliographic entry see Field 07B.
1-04568

CHEMICAL PROCESSES AT THE AIR-SEA INTERFACE: THE BEHAVIOR OF FLUORINE,
Naval Research Lab., Washington, D.C.
P. E. Wilkniss, and D. J. Bressan.
Journal of Geophysical Research, Vol 76, No 3, p 736-741, January 20, 1971. 6 p, 3 tab, 14 ref.

Descriptors: *Water chemistry, *Sea water, *Air-water interfaces, *Ion exchange, Sprays, Evaporation, Aerosols, Bubbles, Surf, Waves (Water), Winds, Chlorides, Fluorides.
Identifiers: *Ion fractionation.

Ion fractionation between fluorine and chlorine at the air-sea interface was investigated. Radiochemical experiments showed a decrease in the F/Cl ratio for laboratory aerosols produced from sea water. Marine aerosols showed an increase in the F/Cl ratio with a possible contribution from airborne dust contamination. Jet drops in the laboratory and naturally occurring marine jet drops showed little to no change. Radiochemical tracers also showed that drying of sea water droplets would sometimes increase the F/Cl ratio of the salt residue, whereas acidification of the sea water always caused the residue to have a decreased ratio. (Knapp-USGS)
W71-04569

CARBON DIOXIDE IN THE PACIFIC OCEAN AND BERING SEA: UPWELLING AND MIXING,
Alaska Univ., College. Inst. of Marine Science.
J. J. Kelley, and D. W. Hood.
Journal of Geophysical Research, Vol 76, No 3, p 745-752, January 20, 1971. 8 p, 5 fig, 17 ref. ONR Contracts NR 307-252, Nonr 477 (24) and N0014-67-A-0317-0001.

Descriptors: *Water chemistry, *Sea water, *Carbon dioxide, *Saturation, *Mixing, Currents (Water), Ocean currents, Ocean circulation, Air-water interfaces.
Identifiers: Oceanic upwelling.

Measurements of the equilibrium concentration of carbon dioxide with respect to air in the surface waters of the North Pacific Ocean and Bering Sea made on a summer 1968 cruise aboard the R. V. Oceanographer were compared with earlier data collected in the southeastern Pacific Ocean off Peru and Chile. Experimental procedure used infrared analysis of equilibrated air and sea water for CO2. Supersaturation of carbonate in the sea with respect to air was noted within northeastern Pacific coastal regions associated with dilution by river inflow and upwelling. Similarly, data obtained off the South American coast showed high surface-water concentrations of CO2 in areas of upwelling. Undersaturation was observed in the northeast Pacific Ocean near Unimak Pass and east of ST. Matthew's Island in the Bering Sea. Near-equilibrium conditions were observed between 48 deg and 49 deg N latitude and from 161 deg to 150 deg 30 min W longitude. (Knapp-USGS)
W71-04570

RELATIONSHIP BETWEEN SALINITY AND CHLORINITY IN THE BUSSE LAGOON, SAKHALIN,
Akademiya Nauk SSSR, Novosibirsk. Institut Geologii i Geofiziki.
For primary bibliographic entry see Field 02L.
W71-04583

VERTICAL ZONING IN CHEMICAL COMPOSITION OF GROUNDWATER IN MASSIFS OF EASTERN MONGOLIA AND SOUTHEASTERN TRANSBAIKAL,
Akademiya Nauk SSSR, Moscow. Research Lab. of Foreign Geology.
B. N. Marinov, and N. A. Marinov.
Translated from Doklady Akademii Nauk SSSR, 1969, Vol 188, No 2, p 434-437, September-October. Academy Sciences USSR Doklady, Earth Science Sections, Vol 188, No 1-6, p 187-190, April 1970. 4 p, 2 tab, 6 ref.

Descriptors: *Water chemistry, *Groundwater, *Hydrogeology, Aqueous solutions, Salinity, Bicarbonates, Calcium, Magnesium, Sulfates, Groundwater movement, Water balance, Water circulation, Leaching, Aquifers, Mineralogy.
Identifiers: *USSR.

Mountainous massifs are widespread in eastern Mongolia and in the adjacent part of southeastern Transbaikal and often constitute long, low ranges. Structurally, they are generally horsts. They consist of metasedimentary, carbonate and extrusive formations of the Precambrian and Paleozoic; terrigenous and sedimentary volcanic formations of the Triassic and Jurassic; and intrusive complexes, ranging in age from Precambrian to middle Mesozoic, inclusively. The groundwater accumulated in these rocks as a result of the irregular distribution of fractures is free in some places but under pressure in others. It is recharged by atmospheric precipitation and condensed moisture. In the distribution and chemical composition of such water there is vertical zoning. The highest parts of massifs hold extremely fresh, calcium or magnesium bicarbonate water with a salinity of 1 g/liter and with a relatively high concentration of silicon dioxide and organic matter. Downslope, owing to the lengthening of seepage routes and to the longer contact of the water with the host rock, the salinity increases gradually, culminating (at 0.4 to 0.8 g/liter) at the foot of mountain slopes. The water varies in composition as well as in salinity; it changes into sulfate-bicarbonate water or water of mixed anionic and cationic composition. (Knapp-USGS)
W71-04584

AQUATIC CHEMISTRY - AN INTRODUCTION EMPHASIZING CHEMICAL EQUILIBRIA IN NATURAL WATERS,
Harvard Univ., Cambridge, Mass. Dept. of Chemistry; and California Inst. of Tech., Pasadena. Dept. of Engineering.
Werner Stumm, and James J. Morgan.
New York, NY, Wiley-Interscience, Div of John Wiley and Sons, Inc, 1970. 583 p.

Descriptors: *Water chemistry, *Water resources, *Surface waters, *Groundwater, *Natural resources, Equilibrium, Chemical reactions, Water quality, Chemical properties, Streams, Lakes, Oceans, Soils, Estuaries, Aquifers, Thermodynamics, Pressure, Water properties, Physiocochemical properties, Aqueous solution, Hydrolysis, Ionization, Solubility, Chemical analysis, Oxidation, Reduction (Chemical), Surface tension, Adsorption.
Identifiers: *Natural waters, Chemical equilibria.

The aims of this book include the formulation of an adequate theoretical basis for the chemical behavior of ocean waters, estuaries, rivers, lakes, groundwaters, and soil water systems, and the description of the processes involved in water treatment. Comparison of the real systems with idealized counterparts or models is made. These simplified and manageable models clearly illustrate the principal regulatory factors that control the chemical composition of natural waters, and in turn, the composition of the atmosphere. Special attention is given to the chemical processes affecting the distribution and circulation of chemical substances, and, the application of elementary principles of physical chemistry in isolating and identifying some of the variables which affect the composition of the water. (Woodard-USGS)
W71-04589

2L. Estuaries

SURF-BEAT ORIGIN FOR PULSATING BOTTOM CURRENTS IN THE RIO BALSAS SUBMARINE CANYON, MEXICO,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02J.
W71-04352

COASTAL LANDFORMS: CRESCENTIC AND RHYTHMIC,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 02J.
W71-04354

METHOD FOR DETERMINATION OF REACTION RATES OF CARBON DIOXIDE WITH WATER AND HYDROXYL ION IN SEAWATER,
Texas A and M Univ., College Station. Dept. of Oceanography; and Alaska Univ., College. Inst. of Marine Science.
Ronald F. Miller, David C. Berkshire, John J. Kelley, and Donald W. Hood.
Environmental Science and Technology, Vol 5, No 2, p 127-133, February 1971. 7 p, 3 fig, 2 tab, 18 ref. ONR Contract Nonr 2119 (04); NSF Contract G18477.

Descriptors: *Water chemistry, *Sea water, *Hydrogen ion concentration, *Carbon dioxide, Kinetics, Aqueous solutions, Equilibrium, Instrumentation, Water analysis.
Identifiers: Sea water chemistry.

The kinetics of pH change in solutions containing carbon dioxide and in contract with a gas phase were studied by determining the rate of pH change in a vigorously bubbled sample of artificial seawater. Variations in the effective constants with temperature and chlorinity are given, and the results are related to the values for the second dissociation constant of carbonic acid in seawater. The rate constants suggest that the role of the hydroxyl ion reaction is more important at the ordinary pH of the sea than had previously been thought. (Knapp-USGS)
W71-04359

ON THE CHARACTERISTICS OF FLOODS IN AN ESTUARY,
Tokyo Inst. of Tech. (Japan).
For primary bibliographic entry see Field 04A.
W71-04409

THE MACROBENTHOS OF THE PAMLICO RIVER ESTUARY, NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh; and North Carolina State Univ., Raleigh. Dept. of Zoology.
Kenneth R. Tenore.
Available from NTIS as PB-197 591, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute Report No 40, (PhD Thesis), Sept 1, 1970. 113 p, 12 tab, 15 fig, 71 ref, append. OWRR Project B-004-NC (8).

Descriptors: *Benthos, *Estuaries, *Estuarine environment, *Environmental effects, *Water pollution effects, *North Carolina, Plankton, Salinity, Temperature, Dissolved oxygen, Sediments.
Identifiers: *Pamlico River Estuary (NC), Anoxic conditions.

A study of the macrobenthos and its environment in the Pamlico River estuary, North Carolina, included measurements of salinity, temperature, and dissolved oxygen, as well as the particle size and organic matter concentrations of the sediments. Salinity ranged from 1 to 20 o/oo, and temperature from 5 to 31C. Anoxic conditions in the bottom water overlying the deeper portions of t estuary occurred in the late summer. Two distinct sediment types were found: a sand substrate in the shallow area, and a silty clay substrate in the deep area of the estuary. The macrobenthos had both low diversity and low density because of harsh environmental conditions of salinity and sediment composition. The absence of benthic life in much of the deeper portions of the estuary correlated directly with anoxic conditions in these areas. On the basis of trellis diagrams, the estuary was divided into three areas: (1) an oligohaline zone dominated by Rangia cuneata and Nereis succinea, (2) a mesohaline zone with a Macoma balthica-Heteromastus filiformis-Nereis succinea association, and (3) a polyhaline zone at the mouth of the estuary characterized by a Macoma phenax-Mulinia lateralis-Glycera dibranchiata association. Vast seasonal changes appeared in species composition, range of distribution, density, and community delimitation caused by the new set of planktonic larvae in the estuary. A total of 36 species was found during the 1968-1969 sampling program. Except for such species as Rangia cuneata and Nereis succinea, most of the benthos underwent great fluctuations due to recruitment from new set. The macrobenthos undergo significant seasonal cycles in the estuary. This report also includes conclusions and recommendations concerning pollution, dredging, and a proposed highway-hurricane-dam complex across the estuary.
W71-04540

BIOTURBATION OF SEDIMENTS IN A NORTHERN TEMPERATE ESTUARY,
Chicago Univ., Ill. Dept. of the Geophysical Sciences; New Hampshire Univ., Durham. Jackson Estuarine Lab.; and New Hampshire Univ., Durham. Dept. of Earth Sciences.
Judith E. Winston, and Franz E. Anderson.
Marine Geology, Vol 10, No 1, p 39-49, January 1971. 11 p, 2 fig, 3 tab, 7 ref.

Descriptors: *Estuaries, *Bottom sediments, *Benthic fauna, *Sedimentation, *Sedimentary structures, Sediments, Mud, Sands, New Hampshire.
Identifiers: *Bioturbation, Polychaetes.

The amount of bioturbation decreases up the Great Bay estuary as salinities become lower and the bottom-dwelling fauna change in composition. Species of the polychaete genus Nereis appear to be the most important turbation agents. Four different levels of bioturbation were observed, ranging from highly turbate in a sandy bottom marine environment near the mouth of the estuary, to non-turbate in a silty bottom brackish water environment near the head of the estuary. (Knapp-USGS)
W71-04561

COMMON STRATIGRAPHIC BOUNDARIES ASSOCIATED WITH COASTAL PLAIN AQUIFERS,
Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 02F.
W71-04577

RELATIONSHIP BETWEEN SALINITY AND CHLORINITY IN THE BUSSE LAGOON, SAKHALIN,
Akademiya Nauk SSSR, Novosibirsk. Institut Geologii i Geofiziki.
L. A. Nepeina, and A. V. Fursenko.
Translated from Doklady Akademii Nauk SSSR, 1969, Vol 188, No 5, p 1111-1112, September-October. Academy Sciences USSR Doklady, Earth Science Sections, Vol 188, No 1-6, p 213-214, April 1970. 2 p, 2 tab, 3 ref.

Descriptors: *Salinity, *Lagoons, *Bays, Evaporation, Mixing, Streamflow, Water balance, Regression analysis, Water analysis.
Identifiers: *USSR, *Sakhalin.

The water of the Busse Lagoon, Sakhalin, USSR, which is connected with Aniva Bay by a narrow strait and also receives much fresh water from streams and creeks, shows no specific persistent relationship between the components of the salt. Surface and bottom samples were taken at 10 stations. The stations were planned to cover all the more and less fresh-water diluted parts of the lagoon and points most representative of the salinity distribution. The salinity and chlorinity of the Busse Lagoon water were fitted into a relationship by the method of least squares. In the chlorinity range of 16.0 to 17.5 percent, the relationship is for Busse Lagoon water: S (in percent) — -1.6979 plus 1.9079 Cl (in percent). (Knapp-USGS)
W71-04583

TEMPERATURE AND WATER-QUALITY CONDITIONS OF THE PATUXENT RIVER ESTUARY, MARYLAND, JANUARY 1966 THROUGH DECEMBER 1967,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-04585

DISSOLVED FATTY ACIDS IN THE JAMES RIVER ESTUARY, VIRGINIA, AND ADJACENT OCEAN WATERS,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 05A.
W71-04586

BIOGEOCHEMISTRY OF TRACE ELEMENTS IN A COASTAL PLAIN ESTUARY: DISTRIBUTION OF MANGANESE, IRON, AND ZINC IN SEDIMENTS, WATER, AND POLYCHAETOUS WORMS,
Bureau of Commercial Fisheries, Beaufort, N.C. Center for Estuarine and Menhaden Research.
For primary bibliographic entry see Field 05A.
W71-04587

SABELLARIA REEF MASSES IN DELAWARE BAY,
Delaware Univ., Newark. Dept. of Biological Sciences; and Delaware Univ., Newark. Marine Lab.
Harry W. Wells.
Chesapeake Science, Vol 11, No 4, p 258-260, December 1970. 3 p, 3 fig, 6 ref.

Descriptors: *Reefs, *Estuaries, *Delaware, *Annelids, Sedimentation, Sedimentary structures, Tides.
Identifiers: *Delaware Bay, *Polychaetes, *Sabellaria reefs.

Along the western shore of Delaware Bay the polychaetous annelid Sabellaria vulgaris builds reefs which are formed of sand grains cemented together in rounded masses of dwelling tubes. They occur principally near the low tide line on sandy beaches in the lower part of the bay, where higher salinity waters, turbulence from wave action, a supply of sand, and a firm or hard substrate occur together. These reefs have important geological and biological effects on the immediate environment, modifying and stabilizing beach sediments, and supporting a distinct community of associated organisms. (Knapp-USGS)
W71-04588

AQUATIC CHEMISTRY - AN INTRODUCTION EMPHASIZING CHEMICAL EQUILIBRIA IN NATURAL WATERS,
Harvard Univ., Cambridge, Mass. Dept. of Chemistry; and California Inst. of Tech., Pasadena. Dept. of Engineering.
For primary bibliographic entry see Field 02K.
W71-04589

TRITIUM STUDY OF THE MIXING OF WATERS IN LAKES AND ESTUARIES, WITH PARTICULAR REFERENCE TO THE LAKE OF GENEVA AND THE GIRONDE (FRENCH),
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research.
For primary bibliographic entry see Field 02H.
W71-04594

SALINITY AND WATER CIRCULATION IN THE VELLAR ESTUARY,
Southampton Univ. (England). Dept. of Oceanography; and Marine Biological Station, Porto Novo (India).
K. R. Dyer, and K. Ramamoorthy.
Limnology and Oceanography, Vol 14, No 1, p 4-15, January 1969. 12 p, 12 fig, 2 tab, 9 ref.

Descriptors: *Estuaries, *Water circulation, *Saline water-freshwater interface, Mixing, Tides,

er flow, Stratified flow, Chemical stratification, rents (Water), Temperature, Salt balance.
ntifiers: India, Vellar estuary, Bay of Bengal, nity gradient.

account is given of the results of a 1967 study of Vellar estuary South India, which discharges the Bay of Bengal. More than 2,200 measure-ts each were made of salinity, temperature, and ed and direction of water currents. This typical built estuary is shown, by comparison with ensionless stratification parameters, to be a water wedge at high rates of river discharge. At reased rates of river discharge the estuary omes well-stratified with the net flow reversing epth and both advection and diffusion con-uting importantly to the upstream salt flux. Dur-the tidal cycle, the salt wedge near the bottom omes isolated in a series of basins during ebb The water circulation at high river discharge s is dominated by a meander system of alternat-scour holes, with the high seaward flow in the est areas. Superimposed on this is a secondary al circulation system that breaks down and rses direction at low river flows when the saline r inflow develops. (Lang-USGS)
-04607

LYBDENUM IN SOME OCEAN AND UARINE WATERS,
hampton Univ. (England). Dept. of Oceanog-y.
Head, and J. D. Burton.
nal Marine Biological Association of the ed Kingdom, Vol 50, No 2, p 439-448, 1970. 2 tab, 21 ref.

riptors: *Molybdenum, *Oceans, *Estuaries, ntic Ocean, Rivers, Seasonal, Sampling, Salini-

tifiers: English Channel (England), Southamp-Water (England).

bdenum in samples of sea water from the En-Channel and from different depths at five sta-in the Northeast Atlantic was determined. average concentrations, 11.5 and 10.9 micor-s molybdenum per liter, respectively, for these os of samples are similar to those reported for other ocean waters and results confirm previ-findings that molybdenum is a relatively rmly distributed element in sea water showing minor and irregular variation with position depth. Measurements of molybdenum in the hampton Water estuary were made over a 16-h period. Results show that distribution of the ent was dominantly controlled by the extent of on with river water having a molybdenum ntration (about 0.3 micrograms/liter), a gible amount compared with sea water. The ge ratio of molybdenum to salinity was 0.346 is similar to that for water of the English nel. The ratio was reduced in spring, probably ological activity, but the amount by which it educed was less than 1/5th of the winter level. pears that the amount of molybdenum in sea will considerably exceed biological require-s in most natural situations. (Jones-Wiscon-

04621

CED PLUME IN A STRATIFIED FLUID,
nal Center for Atmospheric Research, der, Colo.
uglas Fox.
al of Geophysical Research, Vol 75, No 33, p -6835, Nov 20, 1970. 12 fig, 1 tab, 22 ref.

riptors: *Buoyancy, *Stratified fluid, *Flow es, *Froude number, Plumes, Eddy viscocity, ulence.
fiers: *Reynolds stress term, *Entrainment, ent fluid, Boussinesq equation, Molecular city.

odel of a forced plume developed is intended arify and improve existing plume theories. Both the classical theories are developed, as is this one, from the assumption that a plume is a fully developed, steady-state phenomenon independent of the source conditions. The Morton model requires the external specification of entrainment. The Priestly and Ball model does not necessarily neglect the continuity equation, and the external specification of entrainment can be achieved in a less arbitrary manner. A turbulent buoyant yet operating in a linearly stratified fluid is investigated. The rate of entrainment of ambient fluid into the plume is found to be an explicit function of the dependent variables such as: the Reynolds stress, the form of the similarity profiles and the local mean densimetric Froude number. The Reynolds stress term is shown to be related to the constant obtained if the entrainment rate is assumed to be proportional to the mean center line velocity. A critical parameter of the analysis is the ratio of the form of the velocity profile to the form of the density difference profile. Values of this parameter near unity seem most appropriate. Numerical solutions are composed with experimental results to suggest values for the Reynolds stress term. (Herrera-Vanderbilt)
W71-04721

THE UTILITY OF SYSTEMS ANALYSIS IN ESTUARINE WATER QUALITY MANAGEMENT,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-04765

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF DESALINATION MEMBRANES,
General Aniline and Film Corp., Easton, Pa. Central Research Lab.
Herman S. Schultz, and Nathan D. Field.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $1.00. Office of Saline Water Research and Development Progress Report No 609, December 1970. 109 p, 11 fig, 13 tab, 26 ref. OSW Contract 14-01-0001-1807.

Descriptors: *Reverse osmosis, *Membranes, *Synthesis, Desalination, Membrane processes, Osmosis, Waste water treatment, Water purification.
Identifiers: *Copolymers, *Homopolymers, Polyvinyl pyrrolidone, Methyl vinyl ether, Maleic anhydride, Crosslinked films, Diisocyanates.

This report summarizes work on the preparation and evaluation of new reverse osmosis membranes with the objective of finding new polymer reverse osmosis membranes useful for desalinating of brackish and sea water, and/or purification of acid mine and other polluted waters. It was hoped that materials would be found that have a combination of properties superior to those based on cellulose acetate. Water flux, salt rejection, mechanical strength, % water absorption and salt distribution coefficient measurements were used to evaluate the results. Almost all the films studied were of the dense type and the primary focus was on salt rejection rather than water flux. It was felt that materials that showed good salt rejection could be studied subsequently to improve water flux. More specifically, the program consisted of the fabrication of water insoluble membranes based on homo and copolymers of vinyl pyrrolidone and/or vinyl ethers using several broad approaches to be described. Most of the polymers utilized were materials now manufactured commercially by GAF, experimental materials, or reaction products of such materials. Water content and salt distribution coefficient measurements on water-equilibrated films were determined in a number of cases as an aid in evaluating materials. The use of Bierbrich Scarlet dye was found to be a valuable tool for diagnostic purposes beyond the detection of pinholes. (Horowitz-Office of Saline Water)
W71-04426

EFFECT OF POROUS BACKING SUBSTRATES ON MEMBRANE FLUX IN REVERSE OSMOSIS SYSTEMS,
Hydronautics, Inc., Laurel, Md.
Gedeon Dagan, and Arye Gollan.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.35. Office of Saline Water Research and Development Progress Report No 614, December 1970. 21 p, 8 fig, 10 ref. OSW Contract 14-30-2528.

Descriptors: *Desalination, *Reverse osmosis, *Permeability, *Porosity, Membranes, Membrane processes, Osmosis.
Identifiers: *Porous supports, *Composite membranes, Pressure drop, Water flux, Salt rejection, Flux decline.

The effect of porous substrate characteristics on the overall performance of a composite reverse osmosis membrane assembly is investigated for the two most representative concepts, classified as the parallel and radial flow pattern systems. Pressure drop, as well as flux decline curves, as functions of physical parameters of the system are presented. The overall performance of a reverse osmosis membrane depends not only upon its transport properties, but also upon the specific physical system in which it is situated. It is the object of this presentation to briefly summarize the coupled effect of the pressure drop in the membrane substrate for the parallel flow case and introduce the study of two radial flow systems. It is believed that these three basic flow patterns exist in most commonly used systems and may serve as first approximations for many other similar assemblies. (Horowitz-Office of Saline Water)
W71-04427

CHARACTERIZATION OF CELLULOSE ACETATE BUTYRATE MEMBRANES,
Universal Water Corp., Del Mar, Calif.
S. Manjikian, and M. I. Foley.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $1.00. Office of Saline Water Research and Development Progress, Report No 612, December 1970. 110 p, 15 tab, 31 fig. OSW Contract 14-30-2517.

Descriptors: *Reverse osmosis, *Permselective membranes, *Membranes, Membrane processes, Separation techniques, Saline water, Pressure, *Desalination, Osmosis.
Identifiers: Cellulose acetate butyrate, Cellulosics, Casting solutions, Flux, Salt rejection.

Three major areas of interest were investigated in this program. These included the characterization of cellulose acetate butyrate membranes, the optimization of cellulose acetate butyrate membranes, the optimization of butyrate membrane performance and the production of tubular butyrate membranes. In addition, work was initiated on CA-CAB bi-membranes and noncellulosic polymers as membrane materials. Exploratory formulations were prepared and tested to evaluate the effect of certain variations in casting solution compositions on membrane performance. These formulations were directed at increasing flux and compaction resistance for butyrate membranes as well as the development of casting solutions which would be suitable for the production of tubular butyrate membranes. Additives to the standard formulation such as glyoxal, have resulted in 50 to 100 percent improvement in membrane flux with an acceptable reduction in membrane selectivity. In addition, membranes of a wide range of properties were prepared from identical casting mixtures by

varying fabrication conditions, specifically, with diethanolamine as an additive. (Kindley-Office of Saline Water)
W71-04428

SURVEY OF THE ION EXCHANGE PROCESS FOR DESALINATION APPLICATIONS.
Control Systems Research, Inc., Arlington, Va.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $1.75. Office of Saline Water Research and Development Progress Report No 616, November 1970. 222 p, 11 tab, 37 fig, 52 ref, 6 append. OSW Contract 14-01-0001-2275.

Descriptors: *Desalination, *Ion exchange, Demineralization, *Resins, Costs, Reviews, Desalination processes, Separation techniques, Waste water treatment, Water supply, Municipal water.
Identifiers: Moving bed systems, Fixed bed systems, Continuous process systems.

The potential for application of ion-exchange resins to the partial demineralization of brackish water is surveyed. The study documents the results of a literature search of systems which have been investigated, systems currently in use and systems under development for the ion-exchange demineralization of impure water. The ion-exchange resin and equipment manufacturing industries were surveyed to obtain up-to-date information on the availability and capability of ion-exchange resins and systems applications. On the basis of this information the most economically attractive fixed-bed and continuous process systems were chosen, and subjected to cost modelling and sensitivity analysis for a range of municipal water supply rates (0.1, 1.0 and 10.0 MGD) based on a selected range of inland brackish feedwater salinities (1500 to 3000 ppm total dissolved solids). Parameters for design considerations are given, together with basic economic assumptions. The study also considers resin variations, regenerent types and physical plant layout. The appendices contain a glossary, conversion tables and a complete bibliography of ion-exchange references. (Miller-Office of Saline Water)
W71-04429

AN EVALUATION OF DIFFUSION MEMBRANES FOR WASTE WATER REHABILITATION,
Dorr-Oliver, Inc., Stamford, Conn.
For primary bibliographic entry see Field 05D.
W71-04512

DESALINATION OF IRRIGATION RETURN WATERS,
Federal Water Quality Administration, Fresno, Calif. San Joaquin Project.
For primary bibliographic entry see Field 05D.
W71-04552

REVERSE OSMOSIS RENOVATION OF MUNICIPAL WASTE WATER.
Aerojet-General Corporation, El Monte, Calif. Environmental Systems Div.
For primary bibliographic entry see Field 05D.
W71-04669

APPLICATION OF HYPERFILTRATION TO TREATMENT OF MUNICIPAL SEWAGE EFFLUENTS,
Oak Ridge National Lab., Tenn. Water Research Program.
For primary bibliographic entry see Field 05D.
W71-04671

OPTIMIZATION OF AN ELECTRODIALYSIS PLANT,
McDonnell Douglas Astronautics Co., Newport Beach, Calif. Water Technology Dept.
For primary bibliographic entry see Field 08C.
W71-04767

3B. Water Yield Improvement

THE FOREST AS A STOREHOUSE OF CITY WATER, (IN GERMAN),
Vienna (Austria).
Herbert Tomiczek.
Allgemeine Forstzeitung, Vol 81, No 5, p 138-139, 1970. 1 fig, 9 ref.

Descriptors: *Water quality control, *Forests, *Water conservation, Subsurface waters, Runoff, Evaporation control, Filtration.
Identifiers: Vienna (Austria).

Epidemics of cholera and typhoid fever, and other difficulties related to the supply of drinking water experienced by the people of Vienna during the last 100 years are reviewed. The daily per capita use of water in that city increased from 80 liters in 1873 to 416 liters in 1967. The latter rate of consumption demands extraordinary measures among which an important part is attributed to rational forest management. This is particularly true of the regions providing the supply of subterranean water. Forest stands, kept in optimum condition and proper stocking, reduce the loss of water by evaporation and runoff, and serve as natural filters retaining microorganisms. The water conserving role of the forest is appreciably augmented by an enrichment of coniferous stands with broadleaved species. (Wilde-Wisconsin)
W71-04535

HYDROGEOLOGICAL POSSIBILITIES FOR MORE EFFICIENT INTERCEPTION OF GROUNDWATER IN KARST,
Institute for Geological and Geophysical Research, Belgrade (Yugoslavia).
M. Komatina.
Trans. from Vesnik Zavoda Za Geoloska i Geofizicka Istrazivanja, Ser B, No 8, p 83-121. Bulletin of Engineering Geology and Hydrogeology, Ser B, No 8, p 75-110, 1968. 36 p, 14 fig, 3 map, 1 tab, 18 ref.

Descriptors: *Water resources development, *Karst, Water wells, Dams, Reservoirs, Hydrogeology, Grouting, Groundwater movement, Water yield, Discharge (Water), Water balance, Aquifers, Water management (Applied), Water sources.
Identifiers: Horizontal interception galleries, Yugoslavia.

Karst hydrogeology and water development in Yugoslavia are reviewed. Karst terrains have a high hydroelectric potential because of the favorable hypsometric relationships between the water-bearing horizons and the abundant precipitation on their catchment areas. However they are unfavorable from the point of view of making them watertight. In Yugoslavia deep-level sealing is often used, by setting up a grouting apron. In the last 10 years or so comprehensive hydrogeological explorations have been carried out in a number of localities in the Yugoslav karst with the aim of intercepting groundwater for water supplies. Interception is the best way to solve the water supply problems of arid karst regions. While exploratory boreholes are not an efficient method of prospecting, horizontal interception galleries always lead to the development of exploitable quantities of flowing water. Boreholes are particularly unfavorable for exploitation in the littoral karst because they more easily upset the equilibrium between salt and freshwater on pumping. In order to make more efficient use of groundwater in karst, its regime must be artificially regulated. (Knapp-USGS)
W71-04612

INVESTIGATION OF STORM PRECIPITATION PATTERNS OF THE LOS ANGELES RIVER AND SAN GABRIEL RIVER DRAINAGE BASINS AND THE SHIFTS IN THE NA PRECIPITATION PATTERN PRODUC ARTIFICIAL NUCLEATION.
North American Weather Consultants, Calif.

Prepared for Los Angeles County Flood District, NMWC Report No 15-2, June, 196 49 fig, 7 tab, 12 ref.

Descriptors: *Cloud seeding, *Cloud *Storm structure, *Artificial precip *Weather patterns, Chemistry of precip Water resources, Hydrologic cycle, Storm Precipitable water, Rainfall intensity, P maximum precipitation, Rainfall disp California.
Identifiers: *Los Angeles County, San Mountains.

New information on cloud physics and pr tion mechanisms was applied to the clarific natural rainfall distribution and to the ide tion of expected cloud seeding effects in Angeles and San Gabriel River watershed various types of storm conditions. In partic was desired to ascertain why and how some produce heavy intensities of precipitation mountains relative to the valleys and other produce the reverse distribution, a matter siderable concern in the management of flo trol facilities. There was developed in the through mathematical analysis, detailed mo air-flow over a mountain barrier and the precipitation particles from clouds onto the tain surface under a variety of meteorologic ditions. Within the general framework models, formulae were developed in which air mass properties, obtained from rawinso servations taken several hours upwind a Beach Airport and Santa Monica, were rel the difference between mountain area precip rates and those in the upwind valleys. It w cluded that: (1) the employment of the theo storm models as a general guide, and the st regression method as the quantitative asse device, was a rewarding procedure; (2) A DICTION METHOD FOR MAKING HI ACCURATE SHORT TERM QUANTIT PRECIPITATION FORECASTS HAS DEVELOPED ON HISTORICAL DATA; (3) the precipitation prediction method adapted to the evaluation of cloud seeding (Poertner)
W71-04681

3D. Conservation in Domestic Municipal Use

A MODEL FOR CAPACITY EXPA PLANNING OF WATER DISTRIBUTION WORKS,
Massachusetts Inst. of Tech., Cambridge. Ra Parsons Lab. for Water Resources Hydrodynamics; and Massachusetts Univ herst Dept. of Civil Engineering.
For primary bibliographic entry see Field 06
W71-04351

3F. Conservation in Agricultur

IMPACT OF IRRIGATION DEVELOPME INCOME AND TRADE, EASTERN AND TRAL SOUTH DAKOTA,
South Dakota State Univ., Brookings. De Economics.
Thormod Christensen, and Arthur J. Matson.
South Dakota Agricultural Experiment S Bulletin 550, February 1969. 51 p, 8 fig, 57 ref. OWRR Project A-001-SDAK (6).

Descriptors: *Economic impact, *South D *Irrigation programs, *Water management plied), *Cost-benefit analysis, Resource allo Planning, Economic prediction, Evaluatio

, Water conservation, Water allocation (Pol-
Crop production, River basins, Employment
rtunities, Water supply, Stability, Labor,
it, Limiting factors, Education, Industries.
ifiers: *Trade, Trade areas, Resource areas,
cal districts, Business, Sales receipts, Special
es.

study investigated the significance of
rces allocated to irrigation with attention to
and service industries. Such a study allows
-management choices consistent with objec-
Peoples are represented in trade areas,
rce areas, river basins, and political districts.
nal-income increment from adoption of feasi-
rigation in eastern and central South Dakota
stimated to be $55.6 million. Total state gain
be $126 million. Over $111 million would
e to trade-area residents, with $15 million
g over to other areas. Increased trade volume
create new opportunities for business and
yment. The major effect of increased irriga-
improvement in sales receipts and personal
e for resident firms and persons. Reliable ir-
n supply, labor, technical level, and crop
ements are factors in development. Credit
ies are closely involved with irrigation imple-
tion. Irrigation development requires educa-
facilities and special services. Limitations of
udy and suggested future investigations are
ted. Figures and tables present economic-im-
data on irrigation development. (Popkin-
a)
04421

ECULAR STRUCTURE AND HERBICIDAL VITY OF SOME SUBSTITUTED UREAS,
tment of Agriculture, Saint-Jean (Quebec).
rch Station.
logue.
Science, Vol 18, No 5, p 580-582, 1970. 3
ref.

iptors: *Molecular structure, *Herbicides,
s, Toxicity, Halogenated pesticides, Adsorp-
Translocation, Monuron.
fiers: *Substituted ureas, Coriantrum sativum
copersicum esculentum Mill, Diuron, Linu-
Monolinuron, Metobromuron, Chlorbromu-

ffect was determined of slight differences in
ular structure on the relative toxicities of the
tuted urea herbicides. In preemergence appli-
of six different substituted urea herbicides
iander (Coriandrum sativum L) and tomato
persicum esculentum Mill), the
alogenated compounds were more effective
e destruction of plants than their
genated counterparts. The relative dif-
e in effectiveness was much greater in the re-
coriander which appears to take up less
genated than monohalogenated herbicide.
dihalogenated herbicides were generally
more toxic than their monohalogenated
rparts in postemergence application. It ap-
that selectivity could be due to two factors:
ntial absorption and/or translocation and
ntial metabolism. The fact that tomato is
susceptible to all six herbicides in preemer-
and postemergence applications may in-
first, that this plant has no metabolic
e against this group of compounds and
lly, that it absorbs and translocates them
readily to leaves where they are destruc-
Coriander appears to absorb and translocate
nonohalogenated substituted ureas; the
genated compounds appear to be either not
ily absorbed by roots or less readily trans-
d from root tissue. (Jones-Wisconsin)
04534

ECTED PAPERS REGARDING ATES IN AGRICULTURAL WASTE RS.
l Water Quality Administration, San Fran-
Calif.
imary bibliographic entry see Field 05B.

W71-04546

IRRIGABLE ACREAGE IN NEW MEXICO AND PROJECTED DEMANDS FOR IRRIGATION WATER,
New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business.
Marlin L. Hanson.
Available from NTIS as PB-197 660, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Nov. 1970. 10 p, 3 tab, 3 ref. OWRR Project B-008-NMEX (1).

Descriptors: *Irrigation efficiency, Economics, Regression analysis, Statistical models, Costs, Economic feasibility, *New Mexico.

The land area of nine counties in New Mexico was classified according to its economic potential for irrigated crop production. Crop enterprise budgets were developed for production alternatives on 65 soils in the nine counties. Net returns for representative crop combinations were regressed on four soils and two climatic variables to obtain a predictive equation that was used to rate and classify all soils within the nine counties in four irrigable and two nonirrigable classes. Additional analysis is made possible by use of the predictive equations as soil surveys of the remaining counties become available. (Holmes-Rutgers)
W71-04674

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

GROUNDWATER MEASUREMENTS AT THE SITE OF THE SYLVENSTEIN DAM IN THE BAVARIAN ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
For primary bibliographic entry see Field 02F.
W71-04385

THE RELATIONSHIP BETWEEN LAG TIME AND THE PHYSICAL CHARACTERISTICS OF DRAINAGE BASINS IN SOUTHERN ONTARIO,
Queen's Univ., Kingston (Ontario).
For primary bibliographic entry see Field 02E.
W71-04391

THE INFLUENCE OF RESERVOIR STORAGE ON STATISTICAL PEAK FLOWS,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
D. Lauterbach, and A. Leder.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 821-826, 1969. 6 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Peak discharge, *Reservoir storage, *Flood control, Statistical methods, Regulation, Frequency analysis, Reservoir operation, Water management (Applied).
Identifiers: Germany (GDR).

The average influence of reservoirs on peak flows at different recurrence intervals is shown. For some examples the effect of regulation is ascertained and related to the reservoir area percentage. By means of this relation--valid for similar basin characteristics--it is possible to estimate the effect of regulation on natural flood conditions after completion of dams. (Knapp-USGS)
W71-04395

THE ROUTINE ESTIMATION OF SOIL MOISTURE DEFICITS,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 02G.
W71-04396

DETERMINATION OF STORM RUNOFF BY THE USE OF INFILTRATION INDEX,
Ministry of Railways, Lucknow (India).
For primary bibliographic entry see Field 02A.
W71-04397

INTERRELATION OF RIVER WATER AND UNDERGROUND WATER DURING FLOOD PERIODS,
State Hydrological Inst., Leningrad (USSR); and Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02A.
W71-04398

REFORESTATION EFFECTS ON WINTER AND SPRING FLOOD PEAKS IN CENTRAL NEW YORK STATE,
Geological Survey, Washington, D.C.
W. J. Schneider.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 780-787, 1969. 8 p, 4 fig, 7 ref.

Descriptors: *Peak discharge, *Vegetation effects, *Small watersheds, *New York, Vegetation regrowth, Rainfall-runoff relationships, Overland flow, Infiltration, Floods, Runoff, Forest management, Watershed management, Water yield, Statistical methods, Correlation analysis.
Identifiers: Experimental watersheds.

Reforestation of 58% of a small watershed in Central New York reduced winter and spring flood peaks by amounts ranging from 66% in November to 16% in April. Although average reductions of 30% for March and 16% for April are indicated, about one out of seven peaks during these two months is now higher than before the reforestation. The reduction occurred during the 25-year period following reforestation as the 1,250,000 trees planted in 1931 and 1932 grew toward maturity. Since 1958, when crown cover was estimated at 90%, there has been no significant change in the flood peaks. This indicates that the effect of the reforestation on the flood peaks has stabilized and can be expected to remain constant unless the forests are significantly altered. (Knapp-USGS)
W71-04400

STORM RUNOFF FROM FORESTED CATCHMENTS BY SUBSURFACE ROUTES,
Forest Service (USDA), Columbus, Ohio. Northeastern Forest Experiment Station.
R. Z. Whipkey.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 773-779, 1969. 7 p, 2 fig, 14 ref.

Descriptors: *Subsurface runoff, *Overland flow, *Floods, *Peak discharge, *Base flow, Groundwater movement, Hydraulic conductivity, Turbulent flow, Hydraulics, Soil water movement, Flood control, Infiltration, Surface-groundwater relationships.
Identifiers: Subsurface storm runoff.

Subsurface stormflow and not overland flow is the major source of flood flows from wetted, unfrozen forest soils of the Allegheny-Cumberland plateau of the eastern United States. Studies aimed at detaining flow from the catchment showed a need for more knowledge of subsurface flow mechanics and of the nature of the porous medium. Small plot and watershed studies showed greatest quantities and rates of flow from fine-textured soils and lesser amounts from coarse-textured soils. However,

hydraulic conductivity of the soil matrix was too low for the flow to be mass interflow. Further tests showed turbulent storm flow occurred primarily from large biological and structural openings in the profile--even when the soil profile was unsaturated. Further study of soil channel hydraulics is proposed. Preliminary plot treatments using contour trenching and backfilling to break soil channel continuity and soil layers have minimized subsurface storm flow from the catchment region above the trench. (Knapp-USGS)
W71-04401

INFLUENCE OF SOILS, VEGETATION AND GEOMORPHOLOGY ON ELEMENTS OF THE FLOOD HYDROGRAPH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
H. N. Holtan, and N. R. Creitz.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 755-767, 1969. 13 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Flood forecasting, *Hydrograph analysis, *Routing, *Vegetation effects, *Infiltration, *Water storage, Peak discharge, Discharge (Water), Design flood, Design storm, Flood routing, Geomorphology, Reservoir design, Flood control.
Identifiers: Flood hydrographs.

Infiltration capacity during intermittent rainfall is discussed as a function of storage exhaustion with time. A system is presented for estimating the maximum storage capacity of a given soil and for evaluating vegetation as a modifier of storage availability and its rate of exhaustion. A technique is included for computing infiltration recovery during periods of slight or no rainfall. Techniques are demonstrated for rapid computation of the flood hydrograph, or of peak flows only, through application of a storage constant readily obtainable from previously observed hydrograph recessions. Actual and design storms are compared with observed hydrographs. Suggestions are given for research to provide the parameters necessary for application of both infiltration and flood routing procedures. (Knapp-USGS)
W71-04402

FLOOD PLAIN INFLUENCE ON FLOOD WAVE PROPAGATION ALONG A RIVER,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-04403

DESIGN HYDROGRAPHS OF SPRING FLOODS AND METHODS OF THEIR COMPUTATION (BASED ON BYELORUSSIAN RIVER OBSERVATIONS),
Belorusskii Politekhnicheskii Institut, Minsk (USSR); and Ministry of Land Reclamation and Water Economics, Minsk (USSR).
For primary bibliographic entry see Field 02E.
W71-04404

COMPUTATION OF DESIGN SPRING FLOOD HYDROGRAPH,
All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR).
For primary bibliographic entry see Field 08B.
W71-04405

SPRING FLOOD HYDROGRAPH COMPUTATION ON THE BASIS OF DATA ON INFLOW TO THE WATERSHED SURFACE AND INTO THE RIVER SYSTEM,
Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Moscow (USSR).
V. I. Sapozhnikov.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 715-722, 1969. 8 p, 2 fig, 1 tab, 8 ref.

Descriptors: *Flood forecasting, *Snowmelt, *Routing, *Hydrograph analysis, Rainfall-runoff relationships, Climatology, Runoff, Streamflow, Peak discharge, Topography.
Identifiers: USSR.

Schemes which make it possible to compute hydrographs of spring floods for a given inflow to the watershed surface and into the river system, form the basis of runoff forecast methods and calculation of maximum discharge probability. The basic parameters and characteristics of calculation diagrams are determined based on observations from a comparatively dense hydrometeorological network. When determining the inflow of snowmelt water to a basin and calculating its flow down a river system along slopes covered with snow, it is necessary to take into account forest areas, water equivalent of snow cover, snow water storage, areal coverage of snow, air temperature, etc. It is necessary to develop new kinds of observation, such as observation of snowmelt intensity, decrease of the area of snow cover during thawing, intensity of water percolation into the soil, etc., to improve methods of estimating runoff progress during spring floods. (Knapp-USGS)
W71-04406

THE ESTIMATION OF RUNOFF OF LARGE AND MEDIUM RIVERS PROCEEDING FROM THE RUNOFF OF MINOR RIVERS,
State Hydrological Inst., Leningrad (USSR).
M. I. Gourevitch.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 708-715, 1969. 8 p, 4 fig, 1 tab, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Routing, Base flow, Infiltration, Seepage, Streamflow, Runoff, Hydrograph analysis.
Identifiers: Isochrone method, USSR.

A runoff-forecasting method using indicator-basins is proposed. The conditions of the indicator-basins are specified by introducing the notion of homogeneous runoff regions, the time lag is computed, and the dependence of the discrepancy between the observed runoff and that calculated by the isochrones scheme allows calculation of the inaccuracy of the isochrone scheme and the influence of channels unaccounted for by the isochrone scheme. The proposed method can be widely used because the runoff of large and medium rivers may be computed directly from the runoff of small rivers without using rainfall data and infiltration and evaporation losses. (Knapp-USGS)
W71-04407

CALCULATION OF FLOOD DISCHARGES BY MEANS OF THE UNIT HYDROGRAPH,
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
V. I. Mokliak, and T. A. Tchekushkina.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 700-707, 1969. 8 p, 4 fig, 3 tab.

Descriptors: *Flood forecasting, *Unit hydrographs, *Routing, Hydrograph analysis, Discharge (Water), Peak discharge, Hydrographs, Topography, Snowmelt.
Identifiers: Isochrone method, USSR.

The possibility of application of the unit hydrograph to determination of the spring flood discharge is discussed. The hydrograph ordinates are calculated by a specific genetic formula based on construction of isochrones after maximum velocity of water movement in the sections for a given time interval, and on transformation of the discharge in these sections by lag coefficients. A unified UH design allows determination of hydrograph discharges at the outlet at any division of the basin into sections. Whether the process of runoff from all the basin, or the discharge in gaging sections of sub-basins is considered, the hydrograp at the outlet will be the same. The application the suggested unit hydrograph, as shown by calc lated examples, allows solution of the problem the regulating effect of a reservoir system in t basin on spring flood discharges and determinati of the effect of human activity on river flow. napp-USGS)
W71-04408

ON THE CHARACTERISTICS OF FLOODS AN ESTUARY,
Tokyo Inst. of Tech. (Japan).
H. Kikkawa, and H. Shi-igai.
In: Floods and Their Computation, Vol 2, Intern tional Association of Scientific Hydrology Public tion No 85 (Unesco-WMO), p 910-918, 1969. 9 7 fig, 1 tab, 1 ref.

Descriptors: *Estuaries, *Flood control, *Floo forecasting, *Flood routing, *Floodgates, Floo protection, Routing, Tides, Streamflow forecastin Storm runoff, Computer programs.
Identifiers: Japan.

The behavior of floods in an estuary is rather con plicated from the hydrological and hydrodynamic points of view. In particular, the high tides cause by typhons and the functioning of control gates a the most important ones to be treated. Where river is affected by flood and high tides caused b typhoons, the optimum operation of control gat located at the estuary is investigated. The floo routing for a given runoff is also studied for two a tual cases by the use of electronic computers. E forts were made to obtain a stable computin method for high speed and medium speed digit computers with minimum possible computing time and to obtain a satisfactory method of gate opera tion to minimize the maximum water level in th channel. (Knapp-USGS)
W71-04409

STATISTICAL CORRELATION O HIMALAYAN AND BUNDELKHAND BASIN CHARACTERISTICS WITH FLOOD FLOWS,
Uttar Pradesh Irrigation Research Inst., Roorke (India).
S. N. Gupta, A. P. Bhattacharya, and S. R. Jindal.
In: Floods and Their Computation, Vol 2, Interna tional Association of Scientific Hydrology Publica tion No 85 (Unesco-WMO), p 874-880, 1969. 7 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Flood forecasting, *Uni hydrographs, *Statistical methods, Probability, Peak discharge, Frequency analysis.
Identifiers: India, Uttar Pradesh, Himalaya, Bundelkhand.

The flood flow for a basin is generally evaluated either by: (1) empirical formulas, (2) statistical or probability methods and (3) unit hydrograph method. Each method utilizes one or more elements of basin characteristics but none can be considered of universal applicability for the prediction of flood discharge. An attempt was made to correlate peak flood derived by the unit hydrograph method for eight Himalayan and Bundelkhand catchments in Uttar Pradesh with catchment area, stream length, average stream slope and length from gaging station to the center of the catchment. The statistical derivation can be applied to ungaged catchments for evaluating flood flow. (Knapp-USGS)
W71-04411

TRANSFER FUNCTIONS FOR THE ANALYSIS OF RAINFALL-RUNOFF RELATIONS,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02A.
W71-04416

TERMINING ... SEEPAGE CHARACRISTICS OF MILL-TAILINGS DAMS BY IE FINITEELEMENT METHOD,
reau of Mines, Spokane, Wash. Mining Research
b.
r primary bibliographic entry see Field 08D.
71-04425

ALUATION OF THE DECISION PROCESS WATER RESOURCES PLANNING,
nford Univ., Calif. Dept. of Civil Engineering.
r primary bibliographic entry see Field 06A.
1-04516

SERVOIR OPERATION WITH IMPERFECT OW FORECASTS,
ish Columbia Univ., Vancouver. Dept. of Civil gineering.
nuel O. Russell, and Wilham F. Caselton.
CE Proceedings, Journal of the Hydraulics Divi-, Vol 97, No HY2, Paper 7931, p 323-331, ruary 1971. 9 p, 1 fig, 1 tab, 5 ref.

criptors: *Reservoir operation, *Streamflow ecasting, *Simulation analysis, Flood control, ltiple-purpose reservoirs, Irrigation water, ter storage, Snowmelt, Water management plied), Regulation, River forecasting, Synthetic rology.
ntifiers: Okanagan Lake (BC).

ere a large proportion of the runoff originates snowmelt it is usually possible to forecast in- to a reservoir with reasonable accuracy. How-, in the case of reservoirs which are used for flood control and conservation there is always e conflict between the flood control require- t for reservation of space and the conservation irement to store as much water as possible, though good forecasts can minimize the con- Okanagan Lake in British Columbia, Canada, pical of such multi-purpose reservoirs and each the dilemma arises as to whether space should served to meet flood control needs or filled to d against possible droughts. The problem of loping optimal operating policies is examined a method is presented which uses simulation to mble available information from the flow cast, past records of the pattern of flow and the ent lake level in a form which illustrates the able consequences of various courses of action g the forthcoming time period. The operator still make his own decision but can use the ex- y information as a basis for judgment. (Knapp-S)
-04576

ORETICAL PROBABILITY DISTRIBUNS FOR FLOOD PEAKS,
rado State Univ., Fort Collins. Dept. of Civil neering.
Zelenhasic.
rado State University Hydrology Paper No 42, mber 1970. 35 p, 31 fig, 21 tab, 54 ref, 2 ap-. NSF Grant GK-11444.

riptors: *Stochastic processes, *Flood asting, *Probability, *Frequency analysis, istical models, Time series analysis, Peak arge, Hydrograph analysis, Statistical ods, Mathematical studies.
ifiers: Flood peak probability.

wing the theory of the supremum of a random er of random variables, a stochastic model is nted for interpretation, analysis, and predic- of the largest flood peak discharge above a base level. The model can be applied to any of data of an intermittent process having a antial stochastic component for which proba- s of the largest value are desired. The model pplied to data from gaging stations on the ehanna River at Wilkes-Barre, Pa., and the nbrier River at Alderson, W. Va. Results were ared to those obtained by Gumbel's method; indicate that the introduced model fits the better. (Knapp-USGS)

W71-04590

RADIOMETRIC METHOD FOR INVESTIGATING THE PERMEABILITY OF RESERVOIR BEDS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
E. Makowski.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/45, p 727-741, 1970. 15 p, 12 fig, 3 ref.

Descriptors: *Reservoir leakage, *Canal seepage, *Tracers, *Radioactivity techniques, Radioisotopes, Tagging, Tracking techniques, Water loss, Density, Groundwater movement, Soil water movement, Percolation, Seepage.
Identifiers: Reservoir leakage tracing.

To locate leaks under large areas of a reservoir or canal bed a method was developed based on the use of radioactive solutions and radiometry. The method consists in introducing a homogeneous cloud of radioactive solution having a higher density than the surrounding water above the bottom of the reservoir, on which it settles after a few minutes. In places where there is an increased seepage rate (leakage of water) there is always a slight suction, which draws the radioactive solution out of the cloud on the bottom into the crevices and pores in the ground and thus causes a decrease in the radioactivity of the surrounding medium in the immediate vicinity. Repeated monitoring of the distribution of the radioactivity on the reservoir bottom then permits location of the leaking areas and the determination of their approximate extent. Descriptions are given of the method of injecting the radioactive solution, the equipment employed, and the measurement technique. An example is given of the practical application of the method in a reservoir (at Pszeczica, Poland), where the leaks occurring were causing damage to some parts of the anti-seepage layer and then to the dam itself. Investigations using the method described allowed precise determination of the location and extent of the leaking areas of the bed, showed the hydraulic link between these areas and the corresponding escape of water in the medium surrounding the dam, permitted determination of the leakage in the anti-seepage layer and confirmed that under the clay anti-seepage layer there are areas of considerable infiltration, which were the direct cause of the damage. (Knapp-USGS)
W71-04603

NEUTRON INVESTIGATION OF THE RATE OF WATER SEEPAGE FROM IRRIGATION CHANNELS AND RESERVOIRS IN LOESSIAL LOAMS (RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
A. I. Danilin.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/49, p 773-784, 1970. 12 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Reservoir leakage, *Canal seepage, *Loess, Soil water movement, Groundwater movement, Soil density probes, Gamma rays.
Identifiers: *Neutron detectors, Soil density meters.

Experimental field studies on moisture conditions in the ground near an irrigation channel, a reservoir, and the area of ground affected were carried out in the USSR in 1968 with neutron moisture gages and gamma-gamma densimeters. Observations of the moisture movement and soil density were made in permanent boreholes up to 16.5 m deep lined with 2 in. steel tubes sealed at the bottom. An all-purpose probe with a high-efficiency slow-neutron detector and a Pu .. Be neutron source, shows a linear dependence between the thermal neutron count and soil moisture. A portable scaler was used as the measuring instrument. The density probe contained a gamma source with an activity of 2 meq of radium. (Knapp-USGS)
W71-04604

AMEND THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT.
For primary bibliographic entry see Field 06E.
W71-04641

WATERSHED PROJECTS.
For primary bibliographic entry see Field 06E.
W71-04642

AQUATIC WEED CONTROL,
Robert Blackburn, and Ralph Scott.
Southern Water Resources Conference, 14th Meeting, Miami Beach, July 31-August 2, 1968. Council of State Governments, Southern Office, Atlanta, n d, p 13-15.

Descriptors: *Aquatic weed control, *Water resources development, *Administration, *Herbicides, Planning, Weed control, Alligatorweed, Cutting management, Aquatic weeds, Aquatic plants, Water hyacinth, Vegetation effects, Riparian plants, Floating plants, Governments, State governments, Local governments, Federal government, Legislation, Government finance, Mechanical control, Mechanical equipment, Aerial photography, Remote sensing, Surveys.

Outlining state and federal programs for control of undesirable aquatic plants, this speech at the fourteenth meeting of the Southern Water Resources Council notes that, although herbicidal methods may have a detrimental effect on fish and wildlife, they are less harmful than the uncontrolled plants. The new uses of infrared and color photography from aircraft or satellites to survey and locate areas of plant infestation are mentioned, and traditional and modern mechanical plant control methods are discussed. New federal legislation and appropriations are also mentioned. The text concludes that, in place of a project-by-project approach to aquatic weed problems, a comprehensive nationwide control program is needed to permit early detection and control of serious infestation. (Liptak-Florida)
W71-04643

SOCIO-ECONOMIC STUDY OF MULTIPLE-USE WATER SUPPLY RESERVOIRS,
Stone (Ralph) and Co., Inc., Los Angeles Calif.
For primary bibliographic entry see Field 06B.
W71-04672

PROCEEDINGS WORKSHOP ON STREAM CHANNELIZATION AND WETLAND DRAINAGE.
North Carolina Water Resources Research Inst., Raleigh.

Available from NTIS as PB-197 673, $3.00 in paper copy, $0.95 in microfiche. Report No. 45, UNC-WRRI-71-45, (1970). 100 p. Edited by David H. Howells. Conference held at Rougemont, N.C. Nov. 18, 1970. OWRR Project A-999-NC (22).

Descriptors: *Stream channel improvement, *Wetlands, *Ecology, *Aquatic ecosystem, *Environmental effects, Land reclamation, Freshwater marshes, North Carolina.
Identifiers: *Stream channelization, *Wetland drainage.

The objectives of this workshop were to explore the beneficial and adverse effects of stream channelization and wetland drainage in cross-the-table discussion between persons of different points of view, to facilitate more effective project review, and to

identify research needs. Participants included representatives of federal and state agencies, North Carolina Wildlife Federation, League of Women Voters and the University of North Carolina system. Proceedings includes summary of work group discussions under the following headings: Objectives of stream channelization and wetland drainage; Alternatives; Beneficial effects; Adverse effects, Documentation of effects; Effectiveness of mitigating measures; Broader planning implications; Public education; and Research and study needs. (Howells-North Carolina)
W71-04673

RECREATION AND FISH AND WILDLIFE PROGRAM FOR THE STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
David E. Pelgen, and Floyd P. McFadin.
May be obtained from the Dept. of Water Resources, P.O. Box 388, Sacramento, Calif. 95802. Department of Water Resources Bulletin No 117, December, 1968. 31 p, 3 fig, 1 tab.

Descriptors: *Recreation, *Recreation facilities, *Recreation demand, *Wildlife conservation, *Fish management, *California, *Multiple-purpose projects, Water resources development, Conservation, Fish conservation, Social aspects, Water demand.
Identifiers: *California State Water Project.

A proposal is described for implementation of the program of the Department of Water Resources for including recreation and fish and wildlife enhancement features in the State Water Project. The background of the statutory and administrative basis for the program are given, and the present situation is described as well as the Department's schedule for developing recreation and fish and wildlife plans over the next five years within the present framework of the Water Code. The Davis-Dolwig Act of 1961 provided that the development of new recreation sites, along with features that will enhance the State's fish and wildlife resources, be included as a part of the State Water Project. The Act also assigned responsibility for planning such features to the Department of Water Resources. Financing is provided from State Water Project Funds, Tidelands Oil Revenues, and the State General Fund. A number of recreation features have already been constructed at completed Project units. Pertinent sections of the Davis-Dolwig Act are included. The policy of the Resources Agency for carrying out the Davis-Dolwig Program is outlined. (Poertner)
W71-04684

SYSTEMS ANALYSIS FOR URBAN WATER MANAGEMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 06A.
W71-04755

PRELIMINARY POLICY MODELS FOR GREAT LAKES REGULATION,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
For primary bibliographic entry see Field 06A.
W71-04760

AN INTERINDUSTRY FORECASTING MODEL WITH WATER QUANTITY AND QUALITY CONSTRAINTS,
West Virginia Univ., Morgantown. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04761

APPLICABILITY OF SHORT-MEMORY MODES TO ENGLISH RIVER-FLOW DATA,
Birmingham Univ. (England).
For primary bibliographic entry see Field 06A.
W71-04770

INTRA-YEAR WATER STORAGE,
Arta (Greece).
C. Venetis.
Technometrics, Vol 12, No 4, p 741-749, November 1970. 9 p, 9 ref.

Descriptors: *Stochastic processes, *Water storage, *Seasonal, *River flow, *Monthly, *Markov processes, Reservoirs, Equations, Regulated flow.

The purpose of intra-year water storage was to impose upon the seasonally fluctuating river flows some uniformity in order to secure in a probabilistic sense a certain draft, generally varying with season, during all seasons of the year. Monthly flows of the stochastic structure of equations were considered and the approach was based on Moran's Markov chain concept of the reservoir content fluctuations. For the approximate bivariate Markov chain the seasonal limiting distributions were derived. The distribution of the number of occurrences of emptiness during the critical month in N years of reservoir operation was also examined. This distribution was conditional on the month and state of the reservoir content when the reservoir was assumed to start operating. A simple numerical example was computed in order to illustrate the application of the theory. A two-seasonal model was statistically inferred to represent adequately the stochastic generating process of the seasonal inflows. (Kriss-Cornell)
W71-04773

MATHEMATICAL MODEL FOR WATER DISTRIBUTION SYSTEMS,
Arya Mehr Industrial Univ., Tehran (Iran).
For primary bibliographic entry see Field 08B.
W71-04775

SURFACE WATER CONTROL IN NEW JERSEY, PART II: DRAINAGE, FLOOD CONTROL AND RELATED POLICIES IN AN URBAN STATE.
Rutgers-The State Univ., New Brunswick, N.J. Bureau of Government Research.

August 1967. 142 p, 5 append.

Descriptors: *New Jersey, *Surface waters, *Administrative agencies, *Water control, Legislation, State governments, Surface runoff, Repulsion (Legal aspects), Riddance (Legal aspects), Judicial decisions, Legal aspects, Erosion, Storm runoff, Cities, Floodwater, Flood control, Water law, Natural flow doctrine, Drainage, Drainage systems, Drainage districts, Watersheds (Basins), Drainage programs, Urbanization, Water policy.

Part II of a two-part report submitted by the New Jersey Bureau of Government Research, this study on surface water control in New Jersey is divided into two chapters: (1) organizational structure and administration, and (2) substantive programs. The first chapter discusses: (1) considerations in formulating organizational recommendations; (2) state level organization as it involves improvements within the present organizational framework, establishing a new department to administer control of surface water, and a modified interagency mechanism; (3) organization below the state level; (4) county level organization, including county water control agencies and employment of a county hydraulic engineer; (5) regional organization and special agencies, including criteria for using regional agencies, watershed districts, drainage districts, and advisory boards; and (6) overview of the organizational structure. The second chapter examines: (1) functions and powers of the control agency; (2) channel encroachments; (3) maintenance of basic channels; (4) regulating storm drainage facilities and controlling downstream problems; and (5) regulation of use and occupancy of flood plains. (Hart-Florida)
W71-04787

DEBATE AND HOUSE PASSAGE OF TH WATER BANK ACT.
For primary bibliographic entry see Field 06E.
W71-04791

FLOOD PLAIN INFORMATION OF LOWE SOUTH RIVER, METROPOLITAN ATLANT GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps of Engineers Flood Plain Report, May 197 38 p, 11 fig, 75 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Flo plains, *Georgia, Historic flood, Flood forecastin Regional flood, Design flood, Planning, River bas development.
Identifiers: *South River, Henry County, Newto County, Rockdale County (Georgia).

Flooding along South River in DeKalb, Henr Newton, and Rockdale Counties, Georgia betwee Flakes Mill Road and Highway 81 at Snappin Shoals is described to aid in solving local floo problems and in planning the best utilization o flood-prone lands. The report contains map profiles, cross sections, and other data which i dicate extent of flooding that has been experience and that can occur in the future in the Atlanta are Records from U.S. Geological Survey stream ga ing stations, some extending from 1939, are an im portant basis for summarizing the flood situatio The greatest flood known on South River occurre in December 1919, and another great flood, i Bebruary 1961, caused near record stages. Othe large floods occurred in January 1947, Novembe 1948, and March 1942. Duration of flooding relatively short on all streams in the metropolita Atlanta area, but the high velocities in conjunctio with depths greater than 3 ft (up to 20 ft) are ex tremely hazardous. (Woodard-USGS)
W71-04849

4B. Groundwater Management

ISOTOPE TECHNIQUES APPLIED TO GROUNDWATER MOVEMENT IN THE KONYA PLAIN,
State Hydraulic Works, Ankara (Turkey).
F. Senturk, S. Bursali, Y. Omay, I. Ertan, and S. Guler.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/11, p 153-161, 1970. 9 p, 3 fig, 3 tab, 3 ref.

Descriptors: *Tracers, *Deuterium, *Oxygen, *Groundwater movement, Water resources development, Aquifers, Irrigation water, Water sources, Water yield, Groundwater basins, Sampling, Recharge, Discharge (Water).
Identifiers: *Turkey, *Konya plain (Turkey).

As the yields of surface waters in the Konya plain, Turkey decrease noticeably in the summer months the need arises for using groundwater reservoirs for irrigation in the region. The locations of aquifers in the Konya plain were determined by using the stable isotopes oxygen-18 and deuterium. Samples were taken every month at 35 sampling points scattered homogeneously throughout the region. In addition, precipitation samples were collected at three points in the recharge area. The stable isotope values of these samples indicated that two main water bodies with different characteristics existed, one at a shallow and the other at a deeper level, and that they were fed by precipitation of continental type. (Knapp-USGS)
W71-04375

MANAGEMENT AND ADMINISTRATION OF GROUNDWATER IN INTERSTATE AND INTERNATIONAL AQUIFERS, PHASE I,
Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.

on W. Bittinger, and Raphael J. Moses.
able from NTIS as PB-197 592, $3.00 in copy, $0.95 in microfiche. Final Technical t, October 1970. 157 p, 5 tab, 14 fig, 48 ref. R Project C-1195 (No 3144) (1).

iptors: *Groundwater, *Colorado, *Kansas, state, *Administration, *Water Management ied), *Aquifers, Water table, Irrigation wells, laries (Property), Simulation analysis, Prior priation, Legal aspects, Groundwater mining, law, Computer models, International waters. iers: *Ogallala formation, Interstate rs, International aquifers.

and national boundaries are traversed by l surface water and groundwater systems, but w of water in such systems is not influenced se boundaries. Considerable history and ex- ce have developed in the United States over ocation and management of water in in- e and international streams. However, agreements between states or with other ies concerning the development and use of water flowing under a state or international e practically non-existent. This study was ed to be a first look at the physical and legal ns involved with interstate and international s. Approximately 200 interstate and interna- aquifer situations were identified by state and university personnel responding to a nnaire. The principal conclusion derived ne questionnaire results and related litera- search was that many current and potential te and international groundwater problems hich have received little joint attention by es concerned. A case study was conducted e Ogallala formation lying across the do-Kansas state line. The study points out d for similar management to be imposed on des of the state line. Legal aspects were ed and discussed and a proposed interstate t was developed.
4541

VATER INTERFACE DURING GROUND- R PUMPING,
nst. of Tech., Bangkok (Thailand). Div. of Science and Engineering.
L. Ackermann, and Y. Y. Chang.
Proceedings, Journal of the Hydraulics Divi- ol 97, No HY2, Paper 7920, p 223-232, y 1971. 10 p, 4 fig, 1 tab, 8 ref, append.

tors: *Saline water-freshwater interfaces, water intrusion, *Groundwater movement, evels, Porous media, Steady flow, Pumping, able, Stratified flow, Water management d), Water resources development, Saline aline water systems.
ers: Saline water aquifers.

ater, infiltrated over a salt-water-saturated , forms a fresh water zone above the salt hich it displaces. By pumping fresh water ins spaced at periodic intervals in the fresh ne, the depth to the saltwater-freshwater e can be controlled. An analysis relates the um position of the two fluid interface to ping rate, physical properties of the fluids ous media, the geometry describing the cation, and the heads of fresh and salt n electric analog model was constructed to ne validity of the theoretical analysis. (K- GS)
571

GEOCHEMICAL EFFECTS OF INJECT- ASTES INTO A LIMESTONE AQUIFER ENSACOLA, FLORIDA,
al Survey, Ocala, Fla.
ary bibliographic entry see Field 05B.
578

USE OF GROUNDWATER IN DEVELOPING THE MEKONG DELTA, REPUBLIC OF VIET NAM,
Earth Science Research Corp., Santa Monica, Calif.
Eugene D. Michael.
Groundwater, Vol 9, No 1, p 20-24, January-February 1971. 5 p, 1 fig, 7 ref.

Descriptors: *Conjunctive use, *Surface-groundwater relationships, *Groundwater, *Deltas, *Water resources development, Irrigation, Flood control, Water yield, Water storage, Aquifers, Water wells, Water levels, Saline water intrusion, Artesian wells, Confined water.
Identifiers: *Mekong Delta (Viet Nam), Viet Nam.

The Mekong Delta is underlain by an upper section of recent alluvium, and a lower section of older alluvium. The older alluvium contains a permeable artesian zone called the 100-meter aquifer, which is the most productive groundwater reservoir in Viet Nam. Tested well capacities range from about 145 to 635 gallons per minute (gpm); more efficiently designed wells should produce in the range of 500 to 1,000 gpm from this aquifer. Part of the 100-meter aquifer is intruded by sea water. Storage is estimated to be approximately 30 million acre-feet in the lower Delta, where the total dry season irrigation requirement is about 1.2 million acre-feet. The most feasible plan for development of the Mekong Delta may involve the conjunctive use of surface water and groundwater of the 100-meter aquifer, even though induced recharge and a groundwater barrier against sea-water intrusion might be necessary. (Knapp-USGS)
W71-04579

RECHARGE CHARACTERISTICS OF A WATERCOURSE AQUIFER SYSTEM AT SPRINGFIELD, OHIO,
Geological Survey, Columbus, Ohio; and Ohio Dept. of Natural Resources, Columbus. Div. of Water.
Stanley E. Norris, and Herbert B. Eagon, Jr.
Groundwater, Vol 9, No 1, p 30-41, January-February 1971. 12 p, 9 fig, 5 ref.

Descriptors: *Induced infiltration, *Conjunctive use, *Water yield, *Surface-groundwater relationships, *Ohio, Water resources development, Municipal water, Recharge, Withdrawal, Water level fluctuations, Observation wells, Monitoring, Aquifers, Water wells, Hydrogeology.
Identifiers: *Springfield (Ohio).

An investigation was made of infiltration conditions in the alluvial-filled Mad River valley in the vicinity of the Springfield, Ohio, municipal wells. Most recharge to the 100-foot thick sand and gravel aquifer is from induced infiltration from the Mad River. Local precipitation and natural, down-valley underflow also are important in sustaining the 14 mgd pumping rate. Gaging stations were established at points above and below the well field in the expectation that infiltration losses could be measured directly. Observation-well records covering the 4-year period 1965 through 1968 show that groundwater levels follow an annual cycle, typically rising in the period February through June, when recharge exceeds depletion, and falling during the remainder of the year. The rate of induced stream infiltration is not sufficient to prevent perennial dewatering of the aquifer beneath the streambed. During the 7-month depletion period average infiltration is estimated at 9 mgd and during the 5-month accretion period estimated infiltration is 12 mgd. On the basis of these estimates the infiltration rate for the respective periods is 0.37 and 0.50 mgd per acre, or about 0.35 mgd per acre per foot of depth. (Knapp-USGS)
W71-04581

PENETRATION RADIOACTIVE LOGGING FOR THE STUDY OF NON-SATURATED AND SATURATED AREAS (RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. I. Ferronskiy, A. I. Avsyuk, G. I. Grinev, V. I. Demchenko, and B. P. Krovopuskov.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/41, p 673-693, 1970. 21 p, 8 fig, 1 tab, 13 ref.

Descriptors: *Soil density probes, *Radioactive well logging, *Core drilling, Boreholes, Gamma rays, Neutron absorption, Soil moisture meters, Nuclear moisture meters, Sediments, Sedimentology, Soil moisture, Soil water, Geology, Mineralogy, Instrumentation.
Identifiers: *Soil probes (Penetration), Penetration radioactive logging.

A new method of radioactive logging for the study of non-saturated and saturated areas, as well as sea bottoms is based on the insertion of a logging probe to a depth of up to 30 meters. A description is given of the special penetration logging devices used in the field. A combination of radioactive logging and penetration methods provides complete information on the physical and mechanical properties of non-saturated and saturated ground. The characteristics and resolving powers of the gamma, gamma-gamma and neutron-neutron logging methods were investigated. Penetration methods have advantages over radioactive borehole logging methods. No drilling is required, and the results of the determinations made are more accurate. Examples are given of the application of penetration logging methods for the study of various areas in arid and humid regions in connection with irrigation projects. Examples are also given of the study of silts and sandy sediments as well as bottoms covered with silt at the Black Sea coast. Penetration logging data were interpreted for the determination of the lithological composition and the structure of the geological profile, the physical characteristics (volumetric weight and moisture content) of soils, and the spatial distribution of these characteristics in non-saturated and saturated areas. They were also interpreted for the determination of the position of water-bearing strata in the profile and the salt content of the groundwater, and used in wetting tests. (Knapp-USGS)
W71-04601

PLANNED UTILIZATION OF GROUNDWATER BASINS: COASTAL PLAIN OF LOS ANGELES COUNTY,
California State Dept. of Water Resources, Sacramento.
Kiyoshi Mido.
Department of Water Resources, Bulletin No 104, September 1968. 25 p, 13 fig, 6 tab.

Descriptors: *Groundwater basins, *Conjunctive use, *Surface waters, *Surface-groundwater relationships, *Aquifers, Water costs, Water management, Water transfer, Water demand, Coastal plains, Planning, Urbanization, Municipal water, Water supply, Aqueducts, Colorado River Aqueduct, Los Angeles Aqueduct, California.
Identifiers: *Los Angeles County.

Four alternative plans of conjunctive use of ground and surface water resources to meet future water requirements in the service area were analyzed. From this analysis, understanding evolved regarding the economic impact of pumping schedule and pattern, spreading schedule of imported water, and methods of preventing sea-water intrusion. The most significant economic factors are the price of imported water and the proportionate use of imported water and groundwater in storage. The water demand of the Coastal Plain of Los Angeles County is approximately 860,000 acre-feet a year at present and is expected to grow to 1,200,000 acre-feet by 1990. Water supply from various sources which include the Los Angeles Aqueduct, the Colorado River Aqueduct, and soon the State Water Project, will be adequate at least until 1990. One of these sources of supply is the ground water basin in the Coastal Plain. Approximately 35 million acre-feet of fresh water is believed to be in storage at present. (Poertner)

W71-04683

4C. Effects on Water of Man's Non-Water Activities

EFFECTS OF A CAUSEWAY ON THE CHEMISTRY OF THE BRINE IN GREAT SALT LAKE, UTAH,
Geological Survey, Salt Lake City, Utah.
R. J. Madison.
Available from Utah Geological and Mineralogical Survey, Univ. of Utah, Salt Lake City. 84112-Price $2.50. Utah Geological and Mineralogical Survey Water-Resources Bulletin 14, September 1970. 52 p, 13 fig, 7 tab, 14 ref, 3 append.

Descriptors: *Great Salt Lake, *Utah, *Water quality, *Bridges, *Environmental effects, Rock foundations, Rock fills, Porous media, Salinity, Brines, Chemical analysis, Water analysis, Dissolved solids, Data collections, Construction, Water chemistry, Evaporation, Water circulation.
Identifiers: *Railway causeway (Great Salt Lake), *Water quality changes (Great Salt Lake).

During 1957-59, a permeable rockfill causeway was constructed for trains to cross Great Salt Lake, Utah. The causeway divides the lake into two parts and interrupts the formerly free movement of brine about the lake. The causeway has caused significant changes in the chemistry of the lake, including a dilution of the brine in the south part of the lake and a concentration of the brine in the north part. The net movement of dissolved-solids load through the causeway is dependent upon the relationship between the ratio of water discharges in each direction and the concentration of dissolved solids. Estimates made for the 1969 water year indicated that the ratio of total flow northward to total flow southward was about 11:1 through the culverts and about 3:1 through the causeway fill. Discharge through the culverts accounted for about 45 percent of the total brine moving northward but only about 15 percent of the total brine moving southward. (Woodard-USGS)
W71-04369

GEOLOGY FOR ENVIRONMENTAL PLANNING IN MONROE COUNTY, MICHIGAN,
Wayne State Univ., Detroit, Mich. Dept. of Geology.
Andrew J. Mozola.
Michigan Geological Survey Report of Invesitgation 13, 1970. 34 p, 18 fig, 6 plate, 2 tab, 48 ref, append.

Descriptors: *Hydrogeology, *Urbanization, *Michigan, City planning, Water management (Applied), Water resources development, Aquifers, Geology, Water levels, Glacial drift, Waste disposal, Water sources, Water supply, Waste water disposal, Septic tanks.
Identifiers: *Monroe County (Mich).

Monroe County, situated in the extreme southeast corner of Michigan, is underlain by Paleozoic rock strata dipping gently northwest. The bedrock stratigraphic sequence consists largely of carbonate rocks with some sandstones and shales. The bedrock surface is almost completely veneered by glacial drift varying in thickness from a few inches to nearly 160 feet. Over most of the county, however, the drift is considerably less than 30 feet. Only a few natural rock exposures occur at widely scattered localities. Throughout most of the county, except principal urban areas, domestic water supplies are obtained primarily from wells completed in bedrock; and wastes are deposed in septic tanks. The groundwater resource, therefore, is particularly vulnerable to contamination. Knowledge of geologic conditions then becomes a crucial consideration in land-use planning. Accompanying the report is a series of half-inch-to mile county maps depicting bedrock geology, bedrock topography, drift thickness, glacial geology, and piezometric water level. A small bedrock map of the state and a stratigraphic nomenclature chart are also included. (Knapp-USGS)
W71-04370

CHANGE OF RUNOFF DUE TO URBANIZATION,
Public Works Research Inst., Tokoyo (Japan).
T. Kinosita, and T. Sonda.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 787-796, 1969. 10 p, 9 fig.

Descriptors: *Urbanization, *Cities, *Rainfall-runoff relationships, Gaging stations, Streamflow, Model studies, Mathematical models, Routing, Flood routing, Hydrographs, Hydrograph analysis, Synthetic hydrology, Flood forecasting.
Identifiers: Tokyo, Japan.

The Public Works Research Institute (Japan) set up a hydrological network on the Syakuzii river basin in the suburbs of Tokyo to find out changes of runoff due to urbanization. This basin is composed of diluvial deposits, and its area is 48 sq. km. Increase of total flood volume, increase of peak discharge and decrease of travel time are caused by decrease of infiltration area, decrease of roughness ground surface and decrease of inundation area due to urbanization. The basin was divided into subbasins and measured by aerophotographs. Floods in 1966 were computed using a storage-runoff relation which contains formulas of drainage channels and the rate of infiltration area. As the computation agreed well with observation, floods were estimated for the case of complete urbanization. (Knapp-USGS)
W71-04399

THE MACROBENTHOS OF THE PAMLICO RIVER ESTUARY, NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh; and North Carolina State Univ., Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 02L.
W71-04540

WHERE IS URBAN HYDROLOGY PRACTICE TODAY,
Department of Housing and Urban Development, Washington, D.C.
D. Earl Jones, Jr.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY2, Paper 7917, p 257-264, February 1971. 8 p, 15 ref.

Descriptors: *Urbanization, *Rainfall-runoff relationships, *Water management (Applied), *Drainage systems, *Sewers, Utilities, Planning, Storm runoff, Storm drains, Runoff forecasting, Rational formula, Routing, Reviews.
Identifiers: *Urban hydrology.

The evolution of urban street construction and its effects upon urban drainage is reviewed. Rational method development and inconsistencies in its application are summarized. Lack of absolute precipitation data inhibits development of improved runoff prediction methods. Urban drainage areas need dual drainage systems to reduce drainage costs, reduce flood losses, to enhance property values, stabilize neighborhoods, and improve urban life quality. Some basic methods for managing urban runoff also attenuate peak flows. A low maintenance channel is more useful than usual urban channel designs. Direct losses from and expenditures for urban drainage approximate four billion dollars per year. The nation could realize disproportionately great returns from urban hydrology research. (Knapp-USGS)
W71-04572

COMPUTER SIMULATION OF URBAN STO WATER RUNOFF,
Water Resources Engineers, Inc., Walnut C Calif.
Carl W. Chen, and Robert P. Shubinski.
ASCE Proceedings, Journal of the Hydraulics sion, Vol 97, No HY2, Paper 7924, p 289 February 1971. 13 p, 9 fig, 1 tab, 12 ref. FW Contract 14-12-501.

Descriptors: *Storm runoff, *Storm drains, *F ing, *Open channel flow, *Simulation analysis noff forecasting, Hydrographs, Overland Rainfall-runoff relationships, Urbanization, tional formula, Hydrograph analysis.
Identifiers: *Urban hydrology.

As part of an overall storm water management gram, a model was developed to simulate the ru phenomena of a drainage basin for any given fall pattern. The model represents the basin b aggregate of idealized subcatchments and gut The computer is instructed to make a step-by- accounting of rainfall, infiltration, detention, o land flow and gutter flow in the calculation hydrograph. Three preliminary simulations made to demonstrate the validity of the met (Knapp-USGS)
W71-04574

HYDROGEOLOGICAL AND ENGINEER GEOLOGICAL FACTORS IN REGIONAL S TIAL PLANNING,
Institute for Geological and Geophysical Resea Belgrade (Yugoslavia).
S. Lukovic.
Trans. from Vesnik Zavoda Za Geolosk Geofizicka Istrazivanja, Ser B, No 8, p 141- 1968. Available from NTIS as TT-68-50062. letin of Engineering Geology and Hydrogeol Ser B, No 8, p 125-131, 1968. 7 p, 6 ref.

Descriptors: *Hydrogeology, *Urbanizat *Planning, City planning, Area redevelopm Governments, Programs, River basin developm Water resources development.
Identifiers: *Yugoslavia.

Hydrogeological and engineering geological fact in regional spatial planning are reviewed. Th factors always must be taken into account in analysis of these conditions in regional devel ment and urbanization. (Knapp-USGS)
W71-04613

4D. Watershed Protection

AMEND THE WATERSHED PROTECTI AND FLOOD PREVENTION ACT.
For primary bibliographic entry see Field 06E.
W71-04641

WATERSHED PROJECTS.
For primary bibliographic entry see Field 06E.
W71-04642

PROCEEDINGS WORKSHOP ON STREA CHANNELIZATION AND WETLA DRAINAGE.
North Carolina Water Resources Research In Raleigh.
For primary bibliographic entry see Field 04A.
W71-04673

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

ESTIMATION OF ADSORBABLE SOLUTES IN SEAWATER WITH C-LABELLED PHENOL AND ACTIVATED CARBON,
Woods Hole Oceanographic Institution, Mass.
Ralph F. Vaccaro.
Environmental Science and Technology, Vol 5, No 2, p 134-138, February 1971. 5 p, 3 fig, 4 tab, 20 ref.

Descriptors: *Water chemistry, *Sea water, *Organic matter, *Adsorption, *Phenols, Solutes, Aqueous solutions, Laboratory techniques, Activated carbon, Water analysis, Kinetics.
Identifiers: Sea water chemistry.

A C-14 tracer technique is proposed by which the kinetics of short-term uptake of labeled phenol on activated carbon provide a quantitative estimate of the adsorbable material in seawater. The method is calibrated by measuring the amounts of C-14 phenol adsorbed under defined conditions in seawater pretreated with activated carbon to completely remove responsive solutes of natural origin. Kinetics relating phenol adsorption to solute concentration show a saturation-type uptake pattern not unlike that described by the Langmuir equation for an equilibrium situation. For sample analysis, the degree of displacement of the phenol calibration curve is evaluated. Shipboard analyses indicative of the remote Atlantic are compared with simultaneous measurements of total dissolved organic carbon obtained with wet combustion. Since the carbon concentrations measured are similar in magnitude, the bulk of the dissolved organic carbon at locations far removed from shore appears to respond to activated carbon in a manner similar to that of phenol. (Knapp-USGS)
W71-04357

CONTINUOUS EXTRACTION OF ORGANIC MATERIALS FROM WATER,
Geological Survey, Denver, Colo; and Federal Water Quality Administration, Edison, N.J.
Marvin C. Goldberg, Lewis DeLong, and Lloyd Hahn.
Environmental Science and Technology, Vol 5, No 2, p 161-162, February 1971. 2 p, 1 fig, 3 ref.

Descriptors: *Solvent extractions, *Analytical techniques, *Water analysis, *Organic matter, Monitoring, Solutes, Colloids, Separation techniques, Immiscibility, On-site tests, Data collections, Water quality, Organic compounds, Solvents.
Identifiers: *Dissolved organic matter sampling.

A continuous liquid solvent extractor, designed to utilize organic solvents that are heavier than water, is described. The extractor is capable of handling input rates up to 2 liters per hour and has a 500-ml. extractant capacity. Extraction efficiency is dependent upon the p-value, the two solvent ratios, rate and flow of the aqueous phase, and rate of reflux of the organic phase. Extractors can be serially coupled to increase extraction efficiency and, when coupled with a lighter-than-water extractor, the system will allow the use of any immiscible solvent. (Knapp-USGS)
W71-04358

CHEMICAL QUALITY OF MICHIGAN STREAMS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04362

EFFECTS OF A CAUSEWAY ON THE CHEMISTRY OF THE BRINE IN GREAT SALT LAKE, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 04C.
W71-04369

THE IMPACT OF LEAD-ZINC MINING ON THE QUALITY AND ECOLOGY OF SURFACE WATERS IN SOUTHEAST MISSOURI,
Missouri Water Resources Research Center, Rolla; and Missouri Univ., Rolla.
Ernst Bolter.
Available from NTIS as PB-197 528, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, December 1970. 76 p, 3 tab, 19 fig, 38 ref, 6 append. OWRR B-021-MO (2).

Descriptors: Water pollution, Mining industry, *Heavy metals, Analytical techniques, Geochemistry, Copper, *Spectroscopy, Missouri, *Mine wastes, *Pollutant identification.
Identifiers: Lead, Zinc, Viburnum Trend (Mo).

The background concentrations were determined for copper, lead, and zinc in the streams of the Viburnum Trend or New Lead Belt of Southeast Missouri. Analytical methods were developed for atomic absorption spectroscopy. These methods initially consisted of coextraction of copper, lead, and zinc using the APDC/MIBK system, and finally of extraction of copper by APDC/MIBK and direct analysis of lead and zinc using the newly developed 'Sampling Boat' technique. The data obtained from these analyses were arranged in histograms and critically analyzed. The background concentrations were established to be 4-6 ppb for all three elements. Methods are presented for identifying both short term and long term contamination by using the data distributions. Short term contamination of a factor of 2-3 was determined to occur on the Bee Fork below the St. Joseph Lead Company's Fletcher Mine. The data distributions were not useful for geochemical prospecting under the studied geological conditions. It is recommended that future studies be initiated in order to establish the degree of long term contamination introduced by the industrialization of this scenic area. (See also W71-04538)
W71-04537

GEOCHEMICAL EFFECTS OF MINING POLLUTION ON THE STREAMS OF SOUTHEAST MISSOURI,
Missouri Univ., Rolla; and Missouri Water Resources Research Center, Rolla.
Ernst Bolter, and Nicholas H. Tibbs.
Available from NTIS as PB-197 531, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center. OWRR Project A-023-MO (1).

Descriptors: Water pollution, Mining, *Heavy metals, Geochemistry, Streams, Analytical techniques, Missouri, Copper, *Mine wastes, *Pollutant identification.
Identifiers: Lead, Zinc, New Lead Belt (Mo).

Streams in the 'New Lead Belt' of SE Missouri were analyzed for copper, lead and zinc. This area, which a few years ago was sparsely settled and not industrialized, is rapidly developing into the largest lead-zinc mining district of the United States. The data of this study were compared to the results of a pre-mining investigation to determine if the mining activity contributed to the pollution of the streams by heavy metals. Data from an individual mine indicate that the milling waste waters can increase the heavy metal content of the receiving stream up to seven times. However, the heavy metal content of the stream decreases to background concentrations within a distance of three miles. The summarized data of the total area do not indicate a noticeable increase of the heavy metal content in the streams. The average concentrations in the streams at the time of the present investigation were 5.3 ppb for copper, 8.9 ppb for lead and 9.5 ppb for zinc. The calcium content is in the range of 2.45 ppm. The magnesium content in the range of 1-30 ppm. The pH of the streams ranges from 7.0-8.8. It is concluded that the mining activity presently does not significantly pollute the streams with heavy metals. (See also W71-04537 and W71-04182)
W71-04538

DISSOLVED FATTY ACIDS IN THE JAMES RIVER ESTUARY, VIRGINIA, AND ADJACENT OCEAN WATERS,
Virginia Inst. of Marine Science, Gloucester Point.
T. B. Stauffer, and W. G. MacIntyre.
Chesapeake Science, Vol 11, No 4, p 216-220, December 1970. 5 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Organic acids, *Estuaries, *Sea water, *Lipids, Organic compounds, Sampling, Water analysis, Chromatography, Gas chromatography.
Identifiers: *James River (Va), *Fatty acids.

Waters of the James River estuary and adjacent continental shelf were sampled at 34 locations. Dissolved fatty acids were analyzed by gas-liquid chromatography. Total acids generally ranged from 10-25 micrograms per liter while individual fatty acids ranged from 1-4 micrograms per liter. The C14 and C16 chain lengths were dominant for saturated fatty acids, and C14, C16, and C18 were the most common in unsaturated acids. The proportion of odd-numbered chain-length C15 acid was found to be greater in the estuarine than in shelf water. Differences between fatty-acid concentrations of estuarine and ocean water were not sufficient to serve as distinguishing characteristics for these water masses. (Knapp-USGS)
W71-04586

BIOGEOCHEMISTRY OF TRACE ELEMENTS IN A COASTAL PLAIN ESTUARY: DISTRIBUTION OF MANGANESE, IRON, AND ZINC IN SEDIMENTS, WATER, AND POLYCHAETOUS WORMS,
Bureau of Commercial Fisheries, Beaufort, N.C. Center for Estuarine and Menhaden Research.
Ford A. Cross, Thomas W. Duke, and James N. Willis.
Chesapeake Science, Vol 11, No 4, p 221-234, December 1970. 14 p, 9 fig, 8 tab, 34 ref. AEC Contract AT (49-7)-5.

Descriptors: *Trace elements, *Estuaries, *North Carolina, *Water chemistry, *Distribution patterns, Water circulation, Geochemistry, Water temperature, Salinity, Tides, Currents (Water), Bottom sediments, Aquatic animals, Annelids.
Identifiers: *Newport River Estuary (NC).

The distribution of manganese, iron, and zinc in sediments, water, and in six species of polychaetous worms is described for the Newport River estuary near Beaufort, North Carolina. Concentrations of manganese, iron, and zinc in 0.1 N HCl extracts of sediment samples collected monthly from three stations for 2 years varied with element, location, time, and sediment type. At each station, iron was the most abundant element present in the 0.1 N HCl extracts and zinc was the least abundant. The concentrations of all three elements in the sediments decreased in a seaward direction. The relative order of enrichment of trace metals in sediment when compared with water was zinc, iron, and manganese. The order of enrichment of trace metals in polychaetes relative to sediment and water was zinc, iron, and manganese. (Knapp-USGS)
W71-04587

AQUATIC CHEMISTRY - AN INTRODUCTION EMPHASIZING CHEMICAL EQUILIBRIA IN NATURAL WATERS,
Harvard Univ., Cambridge, Mass. Dept. of Chemistry; and California Inst. of Tech., Pasadena. Dept. of Engineering.

For primary bibliographic entry see Field 02K.
W71-04589

MEASURE AN OIL SLICK - AND DISPERSE IT HARMLESSLY.

New Scientist, London, Vol 47, No 716, p 420, August 27, 1970.

Descriptors: *Oil wastes, *Infrared radiation, Solvents, Surfactants, Oily water, Pollutant identification, *Remote sensing.
Identifiers: *Oil slick detection, *Dispersants.

Infrared scanning is being used for accurate plotting of the position and size of oil slicks at sea. Infrared scanner trials over the Santa Barbara Spill demonstrated that oil shows up clearly on the scanner. Considerable progress is also being made in the development of oil dispersants, solvents and surfactants which are harmless to aquatic life. The British Board of trade has authorized the use of several new dispersants at various sites on the coasts of the United Kingdom. (Ensign-PAI)
W71-04799

SHELL SPOTS OIL SPOTS.

Chemical Week, 107 (9), p 15, August 26, 1970.

Descriptors: *Oil wastes, *Pollutant identification, *Monitoring, Oily water, Electronic equipment, Instrumentation, Light intensity.
Identifiers: *Oil detection device, Shell Oil Company, Photocell measurement.

Shell Development scientists at the Emeryville (California) Research Center have come up with a sensitive electronic instrument that can spot minute quantities of hydrocarbon pollutants in water. Tests conducted recently in San Francisco Bay and in southern California near Wilmington, prove the instrument is sensitive enough to detect the presence of six drops of waste oil that was added about 30 feet above the system in a stream moving one ft./second. After detecting the oil, the device sounds an alarm at a remote control station. (Ensign-PAI)
W71-04800

SOME TIME AND SPACE RESOLUTION REQUIREMENTS FOR SPACE OCEANOGRAPHY,
Bureau of Commercial Fisheries, Galveston, Tex.
Robert E. Stevenson.
Advances in Instrumentation Vol 24, Part III. Instrument Society of America. Twenty-fourth Annual Conference Proceedings, Houston, Texas, October 27-30, 1969, p 4. 2 fig, 7 ref.

Descriptors: *Sewage, *Outlets, *Remote sensing, *Aerial photography, Eddies, Pollutant identification.
Identifiers: Space surveys, Coastal pollution.

Spatial resolution and intervals of repetition necessary for optimum utilization of space-derived, remotely sensed data of ocean surface features were determined from photographs taken from manned space flights. Coastal waters place the greatest demands on this space system. Coastal eddies that form sequences of von Karman vortices are some of the ocean surface features that have periods, sizes and enough energy to contribute to local environments. Study of three submarine outlets that carried one billion gallons of sewage to the sea indicated a $1 million per year advantage if daily data were available on the near shore eddy system. (Ensign-PAI)
W71-04801

ANALYTICAL METHODS FOR THE IDENTIFICATION OF THE SOURCE OF POLLUTION BY OIL OF THE SEAS, RIVERS AND BEACHES.

Journal of the Institute of Petroleum, Vol 56, No 548, p 107-117, March 1970. 8 fig, 1 ref.

Descriptors: Water pollution sources, *Analytical techniques, Oil, Oil wastes, *Pollutant identification.
Identifiers: *Identification methods, Sample collection procedures, Recovery procedures, *Oil pollution, Coastal pollution.

Methods of identifying sources of oil pollution are presented. Some of the methods have not yet been standardized but have been found satisfactory in oil company laboratories. Method details are given so other laboratories can carry out the analysis. Sample collection procedures, oil recovery procedures and recovery of other extraneous matter in pollutant samples are briefly discussed. (Ensign-PAI)
W71-04804

AN APPRAISAL OF SEWAGE POLLUTION ALONG A SECTION OF THE NATAL COAST,
Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research.
D. J. Livingstone.
Journal of Hygiene, Cambridge, Vol 67, No 2, p 209-223, June 1969. 4 fig, 3 tab, 18 ref.

Descriptors: *Sewage, *Indicators, *Bacteria, Pollutant identification, Effluents.
Identifiers: Natal Coast, South Africa, E. coli, Parasite units, Staphylococci, Salmonellas, Salinity, Coastal pollution.

Distribution and occurrence of coliforms and pathogenic indicators of pollution in near-shore waters along 47 miles of the Natal Coast before submarine outfalls were surveyed. A short run off an Eastern Cape coastal region was included for comparative purposes. The method was based on Escherichia coli I counts, parasite units, staphylococci, salmonellas and salinity. The study will aid in the assessment of future changes in the water quality of the area. (Ensign-PAI)
W71-04807

OCCURRENCE OF FALSE-POSITIVE MOST PROBABLE NUMBER TESTS FOR FECAL STREPTOCOCCI IN MARINE WATERS,
Connecticut Univ., Storrs. Microbiology Section; and Connecticut Univ., Noank. Marine Research Lab.
John D. Buck.
Applied Microbiology, Vol 18, No 4, p 562-565, October 1969. 1 tab, 17 ref.

Descriptors: *Sewage wastes, Microorganisms, Indicators, *Pollutant identification.
Identifiers: *Fecal streptococci, *Most probable number tests, Azide dextrose, Ethyl violet azide.

Applying the most probable number technique with azide dextrose and ethyl violet azide broths for enterococci, the occurrence of false positive test was common in marine and estuarine water samples. Marine bacterium, gram-positive and gram-negative nonmarine bacteria and yeasts were isolated. All cultures demonstrated growth in azide-dextrose, ethyl violet-azide, and K. F. broths. Representative isolates grew in media containing 0.08% NaN3. The value of the most probable number method for fecal streptococci is questionable in assessing domestic waste levels in estuarine waters. (Ensign-PAI)
W71-04816

USE OF STABLE ELEMENT DISTRIBUTION PATTERNS FOR PREDICTING DISTRIBUTION OF RADIONUCLIDES IN MARINE ORGANISMS,
Puerto Rico Nuclear Center, Mayaguez.
Robert Y. Ting.
BioScience, Vol 19, No 2, p 1082-1084, December 1969. 1 fig, 1 tab, 5 ref.

Descriptors: *Radioisotopes, *Distribution patterns, *Aquatic life, *Foods, Analytical techniques, Sampling, Pollutant identification, Path of pollutant.

The use of stable element distribution patterns predicting the distribution of radionuclides sh that in general food of marine origin contamina by fallout would provide smaller amounts radionuclides per unit weight than would foods terrestrial origin of equal contamination. (Ensi PAI)
W71-04818

PULP MILLS TAKE TO THE AIR TO MO TOR OCEAN OUTFALLS,
Oregon State Univ., Corvallis.
Fred P. Burgess, and Wesley P. James.
Pulp and Paper, Vol 44, No 10, p 66-68, Septem 1970. 5 fig, 1 tab.

Descriptors: *Pulp wastes, Waste water dispo Outlets, *Dispersion, *Aerial photography, D collections, Data processing, *Monitoring, Rem sensing.

Aerial photography offers a possible method studying dispersion of wastes in the ocean, mo toring waste disposal outfalls from pulp mills evaluating possible locations for proposed outfa By using this method, concentrations through the waste plume can be measured in one insta thus allowing the diffusion analysis to be based o nonsteady state model rather than the steady st model. This system is safer and quicker than c ventional methods. (Ensign-PAI)
W71-04825

STUDIES OF POLLUTION IN THE INDI RIVER COMPLEX,
Florida Inst. of Tech., Melbourne. Univ. Center Pollution Research.
T. A. Nevin, and J. A. Lasater.
Florida Academy of Sciences, Quarterly Journ Gainesville, Florida, Vol 32, No 3, p 225-229, S tember 1969. 2 tab, 3 ref.

Descriptors: *Pollutant identification, *Chemi analysis, *Marine bacteria, *Nitrates, *Colifor Chlorides, Lignins, Phenols, Hydrogen ion conc tration.
Identifiers: Estuarine lagoon, Florida Coast.

The Indian River-Banana River Complex is estuarine lagoon of both economic and aesthe value. Studies of the nature and levels of pollut were initiated. Bacteriological evaluations chemical analysis were carried out in surf waters and bottom samples. Nitrate concentrati and coliform bacteria distributions were studied detail. Chloride ion distribution, lignin and tan accumulations and phenol dispersions were vestigated. Cuases of the various levels and the pollutants as indicated from the experiment resu are discussed. (Ensign-PAI)
W71-04830

5B. Sources of Pollution

ADSORPTION OF ISOCIL AND BROMAC FROM AQUEOUS SOLUTION ONTO SOM MINERAL SURFACES,
Oregon State Univ., Corvallis. Dept. of Agric tural Chemistry; and Oregon State Univ., Corval Environmental Health Sciences Center.
Rizwanul Haque, and William R. Coshow.
Environmental Sciences and Technology, Vol No 2, p 139-141, February 1971. 3 p, 2 fig, 2 t 10 ref.

Descriptors: *Adsorption, *Herbicides, *Cl minerals, Illite, Montmorillonite, Humic aci Kaolinite, Silica, Kinetics, Hydrogen bonding, Pa of pollutants, Pesticide kinetics.
Identifiers: *Uracil herbicides, Isocil, Bomacil.

Adsorption of two uracil herbicides, isocil a bromacil, from aqueous solution on illite, mo morillonite, silica gel, humic acid, and daolinte s faces was studied. The adsorption can best represented by Freundich-type isotherms. A hum

acid surface adsorbs considerably more chemical than other surfaces. Montmorillonite and daolinite show a concave-type adsorption, while humic acid exhibits a convex-type. From the adsorption data at two temperatures, the isosteric heats of adsorption as a function of amount of chemical sorbed were calculated. These results suggest a physical-type adsorption for most of the surfaces. At very low surface coverage there is also some hydrogen-bond formation. (Knapp-USGS)
W71-04356

ALTY GROUNDWATER IN THE POCATALCO RIVER BASIN,
Geological Survey, Morgantown, W.Va.
George L. Bain.
West Virginia Geological and Economic Survey Circular Series, No 11, October 1, 1970. 31 p, 8 fig, ref.

escriptors: *Saline water intrusion, *Oil fields, West Virginia, Oil wells, Injection wells, Brines, aline water, Waste water disposal, Water pollution sources, Path of pollutants, Water quality, roundwater, Surface waters.
entifiers: *Oil-field brines.

the Pocatalico River basin of West Virginia, excessive salt concentration in streams and in shallow oundwater has been a problem for some time. ne recent use of hydraulic-fracturing techniques improve the permeability of the area's oil-oducing rocks has caused increased drilling. uch salt brine, as much as 80 bbls of brine for one l of oil, is generally produced with this oil, creatg a brine storage and disposal problem. A number brine-disposal wells have been drilled for re-inction of the oil-field brines into the 'Injun sand' d the shallower 'Salt sands' (Pottsville Group). lt brine, oil, or gas are present everywhere in the lt sands. There is sufficient natural hydraulic ad (pressure) on brine in the Salt sands to coninate overlying fresh-water horizons unless all lls tapping the Salt sands are permanently and perly cased into the Salt sands in this area. (K-pp-USGS)
71-04368

OLOGY FOR ENVIRONMENTAL ANNING IN MONROE COUNTY, CHIGAN,
yne State Univ., Detroit, Mich. Dept. of Geolo-

primary bibliographic entry see Field 04C.
1-04370

NTRIBUTION OF ENVIRONMENTAL ITIUM MEASUREMENTS TO SOME OHYDROLOGICAL PROBLEMS IN UTHERN AFRICA,
versity of the Witwatersrand, Johannesburg uth Africa); Botswana Geological Survey, atse.
primary bibliographic entry see Field 02F.
1-04378

ASUREMENT OF VARIABLE FLOW PATRNS BY A METHOD INVOLVING DILUN OF RADIOACTIVE TRACERS (FRENCH),
mmissariat a l'Energie Atomique, Grenoble nce). Centre d'Etudes Nucleaires.
primary bibliographic entry see Field 08B.
-04383

RMAL PROBLEMS: 'OLD HAT' IN TAIN,
ral Electricity Generating Board, London (End).
Hawes.
ral Electricity Generating Board Newsletter, 3, June 1970. 8 p, 2 fig, 4 tab.

riptors: *Thermal pollution, *Power plants, ution abatement, Foreign design practices, Cooling towers, Oxygenation, Environmental effects, Temperature.
Identifiers: British power stations, Heat disposal.

Cooling water requirements of modern fossil-fuelled plants and of the advanced gas cooled reactors now under construction in Britain are about 120 CFS per 100 MW. Because of the small volumes of water in the rivers in Britain, the electric utilities became interested many years ago in water conservation. Experience gained in Britain could be pertinent to us. The cost of constructing a modern tower-cooled system is considered to be 30 percent more than a direct system of equivalent capacity on the same site. The well-aerated discharge from cooling towers is locally beneficial to a river deficient in oxygen. The reduction in density due to heating is the most important property of heated discharge. The formation of a heated surface layer can be influenced by winds, and special outfall design may be required. A deep intake can prevent the warmed water from recycling. Recently, heat has been injected into physical models to obtain more realistic assessments of the behavior of heated effluents. In theory there is a sound basis that the addition of heat to a river will reduce the solubility of atmospheric oxygen, increase the rate at which oxygen will dissolve into water and increase the rate at which oxygen is used in biological processes. In fact, the oxygen is never decreased between intakes and outfalls of power stations. The occurrence of good angling at the outfalls of many stations suggests that fish can select temperatures they prefer and avoid those they do not. Excessive restrictions can increase electricity costs or result in the inefficient use of natural resources. (Upadhyaya-Vanderbilt)
W71-04431

NITRATES IN PLANTS AND WATERS,
Wisconsin Univ., Madison. Dept. of Soil Science.
D. R. Keeney.
Journal of Milk and Food Technology, Vol 33, No 10, p 425-432, 1970. 1 fig, 7 tab, 54 ref.

Descriptors: *Nitrates, *Plants, *Water, Water pollution sources, Animals, Nitrogen cycle, Fertilizers, Wells, Cropping, Groundwater, Plants, Toxicity, Nitrites, Soils, Mortality, Denitrification, Vegetable crops, Agriculture, Industrial wastes, Organic matter, Ammonification, Nitrification.
Identifiers: Roughage, Methemoglobinemia, Nitrate reductase, Chemo denitrification.

High concentrations of nitrates in waters have been linked to methemoglobinemia in infants, and nitrates in waters and roughage have long been recognized as a cause of animal health deterioration. The problems associated with high concentrations of nitrates in the environment and the forms of nitrogen, transformation of nitrogen in soils and waters, sources of available nitrogen, nitrate movement in soils, and nitrate content of plants are reviewed. Nitrate content of many vegetables appears to be related to factors difficult to control when economically feasible yields are desired. The increase in nitrogen fertilizer usage and waste disposal methods have the greatest impact on nitrate levels in groundwater. The effect of high nitrate concentrations in water, methods to minimize the nitrate content of fresh and processed vegetable products are fields for research as well as investigations to evaluate the effect of high nitrate foods on human beings and on edaphic, genetic, cultural, and processing methods to reduce nitrates in vegetables. (Auen-Wisconsin)
W71-04523

RADIOACTIVITY IN CALIFORNIA WATERS JULY-DECEMBER 1968.
California State Dept. of Public Health, Berkeley. Bureau of Radiological Health.

Radiological Health Data and Reports, p 400-401, 1970. 1 fig, 1 tab, 1 ref.

Descriptors: *Radioactivity, *California, *Water, Analytical techniques, Surface waters, Wells, Streams, Sewage, Industrial wastes, Fallout, Reservoirs, Sampling, Monitoring, Gamma rays, Radium radioisotopes, Strontium radioisotopes, California.
Identifiers: Beta radioactivity, Alpha radioactivity.

California's domestic water supplies, mainly of surface origin, contain natural radioactivity in surface streams, radioactivity added by sewage discharge or by industrial waste effluents, and radioactivity from fallout, particularly fallout into open terminal or distribution reservoirs. Gross beta radioactivity in California domestic waters is monitored by California's Bureau of Radiological Health. A few wells, along with some water supplies that use infiltration galleries, are also sampled. This monitoring is on a continuing basis, since it has not been possible to forecast radioactivity levels in these supplies based upon levels in rain, snow, or surface streams. Monthly 500-ml samples are collected and total solids analyzed for alpha and beta radioactivity. Specific radionuclides are determined semi-annually on composite samples. Gamma-ray emitting nuclides are determined by gamma-ray spectroscopy and radium and radiostrontium by chemical separation and counting. The monthly average beta radioactivity in the suspended-plus-dissolved solids in surface water supplies in California from July through December 1968 are presented. Alpha radioactivity has, usually, been undetectable or very slight. Radioactivity in surface water remains low. No increase has been observed in drinking water due to nuclear device testing during the past several years. (Jones-Wisconsin)
W71-04530

THE IMPACT OF LEAD-ZINC MINING ON THE QUALITY AND ECOLOGY OF SURFACE WATERS IN SOUTHEAST MISSOURI,
Missouri Water Resources Research Center, Rolla; and Missouri Univ., Rolla.
For primary bibliographic entry see Field 05A.
W71-04537

GEOCHEMICAL EFFECTS OF MINING POLLUTION ON THE STREAMS OF SOUTHEAST MISSOURI,
Missouri Univ., Rolla; and Missouri Water Resources Research Center, Rolla.
For primary bibliographic entry see Field 05A.
W71-04538

COLLECTED PAPERS REGARDING NITRATES IN AGRICULTURAL WASTE WATERS.
Federal Water Quality Administration, San Francisco, Calif.

For sale by Superintendent of Documents, U.S. Government Printing Office, Wash, D.C. 20402, I67.13/4:13030ELY Price $1.50. Microfiche from NTIS as PB-197 595, $0.95. Federal Water Quality Administration Water Pollution Control Research Series 13030ELY 12/69, December 1969. 186 p. FWQA Project No 13030ELY.

Descriptors: *Water pollution sources, *Return flow, *Nitrates, *Water pollution control, *California, Drainage engineering, Drainage effects, Irrigation programs, Irrigation systems, Water management (Applied), Eutrophication, Path of pollutants, Groundwater, Irrigation effects, Drainage water, Water quality, Excess water (Soils), Return flow, Drainage programs.
Identifiers: *San Luis Drain (Calif), *San Joaquin Master Drain (Calif), *Central Valley (Calif).

This is a collection of 11 papers dealing with the closely related topics of (a) concentrations of nitrates occurring in subsurface agricultural waste waters, (b) the source of nitrates, and (c) possible methods for controlling or removing them. The work all deals with subsurface agricultural waste waters of the San Joaquin Valley in California, but much of the information may have general applica-

tion. (See also W71-04547 thru W71-04557) (Knapp-USGS)
W71-04546

GENESIS AND SCOPE OF INTERAGENCY COOPERATIVE STUDIES OF CONTROL OF NITRATES IN SUBSURFACE AGRICULTURAL WASTE WATERS,
Bureau of Reclamation, Sacramento, Calif.
For primary bibliographic entry see Field 05G.
W71-04547

PREDICTING CHANGES IN NITROGENOUS COMPOUNDS IN SOIL-WATER SYSTEMS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 05G.
W71-04548

THE MOVEMENT OF NITROGENOUS FERTILIZERS THROUGH SOIL COLUMNS,
Bureau of Reclamation, Fresno, Calif.
John W. Williford, Thomas C. Tucker, Robert L. Westerman, and Doyle R. Cardon.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030ELY 12/69, p 29-39, December 1969. 11 p, 1 fig, 9 tab. FWQA Project 13030ELY.

Descriptors: *Leaching, *Nitrates, *Soil water movement, *Fertilizers, *Irrigation effects, California, Path of pollutants, Lysimeters, Model studies, Hydraulic models, Drainage programs, Drainage water, Water pollution sources.
Identifiers: *Central Valley (Calif), *Groundwater pollution.

To study movement of nitrates in soil systems, 14 lysimeters made of techite (fibre glass) pipe 15 inches in diameter and 6.7 feet in length were filled with four major soil types from the west side of the San Joaquin Valley of California. The volumes extracted from the probes and collected in the leachates were recorded. All of the samples were analyzed for chlorides, ammonia, total nitrogen and atom percent excess N. The nitrate levels in leachates collected during initial leaching and before fertilization ranged from 20,000 ppm in the Oxalis clay to 2,500 ppm in the Panoche fine sandy loam. These high nitrate levels indicate how relatively low levels of native nitrates can be concentrated in the groundwater by leaching. The highest percentage of fertilizer -N was leached from soils to which KNO3 was applied. In Panoche fine sandy loam and Lethent sandy clay loam, respectively, 82 and 65% of the total nitrogen collected in the soil extract was fertilizer-N. By comparison, only 14 to 24% of the N in the extract was fertilizer -N when ammonium sulfate and sulfur-coated urea were the N sources. Much of the added NH4-N is tied up by the clay complex of the soil near the soil surface. Since only 30% of sulfur-coated urea was readily soluble and the remainder was treated to dissolve slowly, movement of nitrogen as urea could be expected to be approximately 30% of N movement from KNO3 assuming appreciable hydrolysis did not occur. (See also W71-04546) (Knapp-USGS)
W71-04549

AGRICULTURAL NITRATE REDUCTION AT A WATER TABLE,
Agricultural Research Service, Brawley, Calif. Southwestern Irrigation Field Station.
L. S. Willardson, and Burl D. Meek.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030ELY, 12/69, p 41-52, December 1969. 12 p, 6 fig, 2 ref. FWQA Project 13030ELY.

Descriptors: *Leaching, *Nitrates, *Soil water movement, *Fertilizers, *Irrigation effects, California, Path of pollutants, Lysimeters, Model studies, Hydraulic models, Drainage programs, Drainage water, Water pollution sources.
Identifiers: *Central Valley (Calif), *Groundwater pollution.

Laboratory studies on large soil columns with a controlled water table and submerged drains show that very low nitrate content water can be delivered from agricultural drains. A field experiment on drain submergence which intercepts groundwater high in native nitrate indicates that denitrified water from irrigated agriculture can reduce nitrate concentrations in drainage water by dilution. Where proper conditions can be established, including oxygen shortage, adequate organic carbon as an energy source, and a bacterial population, anaerobic conditions develop and result in denitrification. Based on the results obtained in the columns, a nitrate-nitrogen content of 500 ppm in the groundwater would require a surface application of 1,000 pounds per acre of nitrogen as a nitrate fertilizer in a single application. (See also W71-04546) (Knapp-USGS)
W71-04550

MONITORING NUTRIENTS AND PESTICIDES IN SUBSURFACE AGRICULTURAL DRAINAGE,
California State Dept. of Water Resources, Fresno. Quality and Treatment Unit.
L. R. Glandon, Jr., and L. A. Beck.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030 ELY, 12/69, 53-79, December 1969. 27 p, 6 fig, 6 tab, 14 ref. FWQA Project 13030 ELY.

Descriptors: *Leaching, *Nitrates, *Chlorinated hydrocarbon pesticides, *Fertilizers, *Irrigation effects, California, Path of pollutants, Drainage programs, Drainage water, Water pollution sources.
Identifiers: *Central Valley (Calif.), *Groundwater pollution.

The concentrations of nitrogen, phosphorus, and chlorinated hydrocarbon pesticides were measured in agricultural subsurface drainage from tiled areas of the San Joaquin Valley in California. Average concentrations of nitrogen and phosphorus ranged from 2 to 400 mg/liter and 0.01 to 4.0 mg/liter. Large seasonal variations of tile drainage discharge were observed in all areas and were attributed mainly to irrigation. Tile drainage systems in the northern area discharged the greatest amounts of effluent at 1.8 acre-feet per acre per year. Nitrogen concentrations were the highest in combined drainage from the central area; the average annual concentration was 33 mg/liter; seasonal variation ranged from 22 to 51 mg/liter. Recent and older alluvial soils were higher in nitrogen than basin soils. The quantity of nitrogen in tile drainage seldom correlated with the amounts applied. Chlorinated hydrocarbon pesticide concentrations have decreased in tile drainage from all areas investigated for the last 6 years. Pesticide use records from Kern County showed definite decreases in usage of chlorinated hydrocarbons in favor of organic phosphates. Variations in nitrogen concentrations of tile drainage are more dependent upon the physiographic position and soil series than all other factors. High original nitrate contents of soils account for greater quantities of nitrogen in tile drainage than that contributed by fertilizers. (See also W71-04546) (Knapp-USGS)
W71-04551

DESALINATION OF IRRIGATION RETURN WATERS,
Federal Water Quality Administration, Fresno, Calif. San Joaquin Project.
For primary bibliographic entry see Field 05D.
W71-04552

BACTERIAL DENITRIFICATION OF AGRICULTURAL TILE DRAINAGE,
Federal Water Quality Administration, Fresno, Calif. San Joaquin Project; and Stanford Univ., Calif. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05D.
W71-04553

ALGAL NUTRIENT RESPONSES IN AGRICU TURAL WASTE WATER,
Federal Water Quality Administration, Fres Calif.; and California State Dept. of Wa Resources, Fresno.
For primary bibliographic entry see Field 05D.
W71-04554

THE EFFECTS OF NITROGEN REMOVAL THE ALGAL GROWTH POTENTIAL OF SA JOAQUIN VALLEY AGRICULTURAL TI DRAINAGE EFFLUENTS,
California State Dept. of Water Resources, Fres and Federal Water Quality Administrati Alameda, Calif.
For primary bibliographic entry see Field 05D.
W71-04555

HARVESTING OF ALGAE GROWN AGRICULTURAL WASTE WATERS,
California State Dept. of Water Resources, Fres and Bureau of Reclamation, Fresno, Calif.
For primary bibliographic entry see Field 05D.
W71-04556

COMBINED NUTRIENT REMOVAL AN TRANSPORT SYSTEM FOR TILE DRAINA FROM THE SAN JOAQUIN VALLEY,
California State Dept. of Water Resources, Fres and Federal Water Quality Administration, Fres Calif.; and California Univ., Berkeley. Dept. Sanitary Engineering and Public Health.
For primary bibliographic entry see Field 05D.
W71-04557

HAZARDS OF MERCURY.
For primary bibliographic entry see Field 05C.
W71-04558

NUMERICAL SIMULATION OF DISPERSIO IN GROUNDWATER AQUIFERS,
Colorado State Univ., Fort Collins. Dept. Agricultural Engineering; and Colorado Sta Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-04559

HYDROGEOCHEMICAL EFFECTS OF INJEC ING WASTES INTO A LIMESTONE AQUIFE NEAR PENSACOLA, FLORIDA,
Geological Survey, Ocala, Fla.
Donald A. Goolsby.
Groundwater, Vol 9, No 1, p 13-19, Januar February 1971. 7 p, 9 fig, 1 tab, 10 ref.

Descriptors: *Path of pollutants, *Water pollutio effects, *Injection wells, *Waste disposal, *Florid Hydrogeology, Geochemistry, Injection, Aquifer Groundwater movement, Aquicludes, Confine water, Monitoring, Observation wells.
Identifiers: *Waste disposal wells, *Florida aquifer, Pensacola (Fla).

Acidic industrial wastes have been injected in deep wells in a limestone aquifer near Pensacol Florida, since 1963. Prior geohydrologic studies i dicated that the limestone aquifer contained no potable water and was overlain by an extensive cla confining layer. Two injection wells are being use to inject the waste at a rate of approximately 2,00 gallons per minute. The injection pressures ar about 200 pounds per square inch. Over 3 billio gallons have been injected. Current study indicate that the waste extends outward about 1 mile fro the injection wells, and pressure effects extend ou ward more than 25 miles. Monitor wells show tha pressure changes are following a predictable pat tern. No wastes have been detected in a monito well open to the Floridan aquifer immediatel above the Bucatunna Clay Member of the Byran Formation and 100 feet from one of the injectio

lls. In a monitor well open to the receiving for-
tion about 1,300 feet south of the injection
lls, effects of the wastes were detected about 10
nths after injection began. In early 1968, the pH
he waste was lowered to about 3. Effects of this
nge were detected at the monitor well about 5
nths later. (Knapp-USGS)
1-04578

MPERATURE AND WATER-QUALITY CON-
IONS OF THE PATUXENT RIVER ESTUA-
MARYLAND, JANUARY 1966 THROUGH
CEMBER 1967,
ological Survey, Washington, D.C.
primary bibliographic entry see Field 05C.
1-04585

GEOCHEMISTRY OF TRACE ELEMENTS
A COASTAL PLAIN ESTUARY: DISTRIBU-
N OF MANGANESE, IRON, AND ZINC IN
IMENTS, WATER, AND POLYCHAETOUS
RMS,
au of Commercial Fisheries, Beaufort, N.C.
er for Estuarine and Menhaden Research.
primary bibliographic entry see Field 05A.
-04587

LEAR TECHNIQUES IN STUDIES OF
ERSION AND SOME OTHER PROPER-
OF THE DANUBE,
ut za Nuklearne Nauke Boris Kidric, Belgrade
oslavia); and Institut za Vodoprivredu
lav Cerni, Belgrade (Yugoslavia).
primary bibliographic entry see Field 02E.
-04592

TROL OF SPILLAGE OF HAZARDOUS
LUTING SUBSTANCES,
lle Memorial Inst., Richland, Wash. Pacific
west Labs.
rimary bibliographic entry see Field 05G.
04615

ED STATES V TANKER MONSOON
OVERY FOR WRONGFULLY IMPOSED
POLLUTION CLEAN-UP COSTS).
rimary bibliographic entry see Field 06E.
04663

A BARBARA OIL POLLUTION, 1969, A
Y OF THE BIOLOGICAL EFFECTS OF
OIL SPILL WHICH OCCURRED AT
A BARBARA, CALIFORNIA, IN 1969,
rnia, Univ., Santa Barbara.
imary bibliographic entry see Field 05C.
04670

ECONOMICS OF CLEAN WATER:
AL WASTES PROFILE.
l Water Pollution Control Administration,
ngton, D.C.

le by Supt. of Documents, U. S. Govt. Print-
fice, Washington, D. C. 20402. Price $1.00.
1970. Vol 2, 85 p, 18 fig, 10 tab.

ptors: *Animal populations, *Farm wastes,
r pollution sources, *Water pollution con-
Cost analysis, Cattle, Sheep, Poultry, Hogs,
ck.
iers: *Animal wastes, *Clean water,
ots, Swine, Milk cows, Stream pollution.

prehensive view is provided of the problem
-animal wastes in the United States in rela-
to pollution of water bodies. A framework
lished for estimating costs of animal wastes
to prevent water pollution. In many cases
wastes have proved to be significant pollu-
rces that resulted in fish kills and extensive
to the ecology of the streams. At the
time, however, there is general agreement that not all of the wastes need to be considered as sources of water pollution. Therefore, it would seem that entirely too much emphasis has been placed on the gross possible costs of controlling water pollution from animal wastes. A more realistic base for use in developing programs for water pollution abatement and control from animal wastes is a series of sub-elements that can be independently assessed to determine their pollution potential, applicable control measures, and total pollution control costs. Estimates are presented of the locations, by states, of populations of cattle, milk cows, swine, sheep, and poultry together with discussions of water pollution control practices, wastes discharge frequencies from feedlots, and climate effects. (See also W71-00737, W71-00738, and W71-04686)
W71-04685

THE ECONOMICS OF CLEAN WATER: INORGANIC CHEMICALS INDUSTRY PROFILE.
Federal Water Pollution Control Administration, Washington, D.C.

For sale by Supt. of Documents, U. S. Govt. Printing Office, Washington, D.C. 20402. Price $3.50. March 1970. Vol 3, 467 p, 64 fig, 65 tab, 86 ref.

Descriptors: *Chemical wastes, *Water pollution sources, *Water pollution treatment, *Waste water treatment, *Pollution abatement, *Inorganic compounds, Chlorine, Fertilizers, Brine disposal, Paints, Inorganic pesticides, Alkalis, Costs.
Identifiers: *Inorganic chemical wastes, Chemical industry wastes, Inorganic wastes.

A description is presented of the inorganic chemical industry, the manpower requirements and costs that the industry would incur in attaining various levels of water pollution abatement over a five year period through 1974. The cost estimates have been based upon published data, general data from contractors on industrial waste treatment methods and costs, and specific data from 59 inorganic chemical plants. The inorganic chemical industry has been defined for purposes of this study as including establishments producing alkalies and chlorine, industrial gases, inorganic pigments, paints and allied products, fertilizers (excluding ammonia and urea), inorganic insecticides and herbicides, explosives, and other major industrial inorganic chemicals. The various production processes, the waste treatment methods practiced, and the possible impact that changes in waste produced are described. Contaminated waste water from the inorganic chemical industry comes primarily from electrolysis and crystallization brines, washings from filter cakes, spent acid and alkalies, and washings from raw materials. (See also W71-00737, W71-00738, and W71-04685)
W71-04686

MODELING DIURNAL FLUCTUATIONS IN STREAM TEMPERATURE AND DISSOLVED OXYGEN,
Utah Water Research Lab., Logan.
A. D. Kartchner, N. Dixon, and D. W. Hendricks.
Proceedings of the Industrial Waste Conference, 24th, 1969. Purdue University Engineering Extension Series No 135, Part One, p 436-449. 16 fig, 1 tab, 6 ref.

Descriptors: *Water temperature, Dissolved oxygen, Mathematical models, Time series analysis, Temperature.
Identifiers: Little Bear River, Diurnal fluctuation, Fourier Series, Stream temperature.

During the last three years, a project at the Utah Water Research Laboratory has been developing a simulation model for the hydrology and water quality of the Little Bear River, a small mountain valley river system in northern Utah. Two different modeling approaches are inductive empirical mathematical techniques chosen on the basis of their ability to describe the observed data. The two approaches are a Fourier Series curve fitting approach and a time series index approach. The models account for approximately 90 percent of the total variation in the DO data and about 75 percent in temperature data. The time series index model yields a standard deviation for DO of 0.23 mg/l while the Fourier series model gives a value of 0.25 mg/l. The standard deviation for temperature are 0.67C and 0.66C, respectively. To ascertain the character of seasonal changes in these diurnal fluctuation pattern and 22 data blocks representing different times of the year have been analyzed. The modeling curves were obtained by multiplying the mean value by the diurnal indexes determined from the data. (Upadhyaya-Vanderbilt)
W71-04720

FORCED PLUME IN A STRATIFIED FLUID,
National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 02L.
W71-04721

MINIMIZING ABATEMENT COSTS OF WATER POLLUTANTS FROM AGRICULTURE: A PARAMETRIC LINEAR PROGRAMMING APPROACH,
Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04738

ANALYTICAL METHODS FOR THE IDENTIFICATION OF THE SOURCE OF POLLUTION BY OIL OF THE SEAS, RIVERS AND BEACHES.
For primary bibliographic entry see Field 05A.
W71-04804

LEVELS OF STABLE ZN AND 65ZN IN CRASSOSTREA VIRGINICA FROM NORTH CAROLINA,
Bureau of Commercial Fisheries, Beaufort, N.C. Radiobiological Lab.
For primary bibliographic entry see Field 05C.
W71-04812

5C. Effects of Pollution

VASCULAR AQUATIC PLANTS IN ACID MINE WATER OF THE MONONGAHELA RIVER,WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
Roy B. Clarkson, and Jerry A. Moore.
Available from NTIS as PB-197 526, $3.00 in paper copy, $0.95 in microfiche. 1971. 8 p, 1 tab, 1 fig, 9 ref, Bulletin 2, West Virginia University Bulletin, Series 71, No 7-5. OWRR Project A-005-WVA (3).

Descriptors: *Aquatic plants, *Acid mine water, *Water pollution effects, *Rooted aquatic plants, *Submerged plants, Water pollution, Aquatic weeds, Cattails, Floating plants, Pondweeds, Plants, Aquatic life, West Virginia, Water quality.
Identifiers: *Vascular aquatic plants, Monongahela River basin.

A study of vascular aquatic plants in three West Virginia acid mine water polluted rivers--the Monongahela, Tygart Valley, and West Fork--found plants abundant in many areas. The most common species is Eleocharis acicularis (L.) R. and S. The next most abundant plants are Sagittaria graminea Michx., S. latifolia Willd., Potamogeton epihydrus Raf., P. nodosus Poir., Sparaganium americanum Nutt., and Myriophyllum heterophyllum Michx. Six areas were chosen for intensive study. Water samples from each were analyzed chemically for nitrogen, phosphate, calcium, total acidity, iron and pH. Physical factors studied were the substrate, water velocity, and water-level fluctuation. From a stepwise discriminant analysis, substrate was determined to be the primary physical factor in determining plant distribution. Phosphate

and water-level fluctuation were also significant. Nitrogen, calcium, total acidity, iron, pH, and water velocity were determined to be nonlimiting for the species studied. (Clarkson-West Virginia)
W71-04418

A PRACTICAL APPROACH TO THE ENVIRONMENTAL EFFECTS OF THERMAL DISCHARGES,
Industrial Bio-Test Labs., Northbrook, Ill. Environmental Sciences Div.
Lawrence P. Beer, and Wesley O. Pipes.
Proceedings of the Industrial Waste Conference 24, p 727-744, May 1969. 5 fig, 5 tab, 4 ref.

Descriptors: *Thermal pollution, Temperature, Thermal powerplants, Cooling, Pollution identification, Cooling water, Lake Michigan, Mississippi River, Biological properties, Chemical properties, Fish, Water pollution, Water temperature, Plankton, Benthos, Nuclear powerplants.
Identifiers: Thermal Pollution Surveys.

The technique used in practical surveys on thermal discharges is discussed. The approach consists of: (1) physical measurements, (2) chemical analyses, and (3) biological analyses. This type of survey has been applied to a limited number of locations and those described here are: Lake Michigan, and Mississippi River. Data taken at these sites are summarized. The main conclusions of the paper are: (1) solution to thermal pollution problems will have to be based on evaluation of the particular aquatic environment in question; (2) Field technique of making these evaluations is available and provide a good representation of actual conditions. (3) Continued monitoring of the environment is necessary to determine the relevance of the present water quality standards and to protect industries from unfounded attacks. (Novotny-Vanderbilt)
W71-04430

THERMAL PROBLEMS: 'OLD HAT' IN BRITAIN,
Central Electricity Generating Board, London (England).
For primary bibliographic entry see Field 05B.
W71-04431

DISSOLVED OXYGEN AND TEMPERATURE DATA FOR THE WABASH RIVER FROM CLINTON TO HUTSONVILLE - 1967-68,
Weston Paper and Mfg. Co., Terre Haute, Ind.
A. Elmer Guerri.
Proceedings Industrial Waste Conference 24, p 807-849, May 1969. 15 fig, 26 tab.

Descriptors: *Water pollution, *Thermal pollution, *Temperature, *Dissolved oxygen, Waste assimilative capacity, Indiana, Biochemical oxygen demand, Photosynthetic oxygen, Waste disposal, Rivers.
Identifiers: Waste assimilative capacity surveys.

The dissolved oxygen and thermal conditions of the Wabash River in the Terre Haute area have been studied. It was observed that there was a definite relationship between river temperature and dissolved oxygen concentration, and that there was little if any relationship between stream flow and dissolved oxygen. It was found that the temperature increased as the water flowed through the stretch of the river under consideration. The survey data indicated that there was practically no deterioration of the river as it passed through the Terre Haute stretch, due to the addition of organic matter that can be biologically decomposed. (Novotny-Vanderbilt)
W71-04432

EXPERIMENTAL CAGE CULTURE OF CHANNEL CATFISH ICTALURUS PUNCTATUS IN THE HEATED DISCHARGE WATER OF THE MORGAN CREEK STEAM ELECTRIC GENERATING STATION, LAKE COLORADO CITY, TEXAS,
Texas Electric Service Co., Fort Worth.
John E. Tilton, and James F. Kelley.
Second Annaul Workshop, World Mariculture Society, Baton Rouge, Louisiana, February 9, 1970. 14 p, 7 fig, 3 tab, 2 ref.

Descriptors: *Temperature effects, Fish, Heat pollution, *Thermal pollution, Thermal power plants, Lakes, Ponds, Temperature, Fish farming, Water pollution effects, Catfishes, *Channel catfish, Texas.
Identifiers: Ictalurus Punctatus, Lake Colorado (Texas).

Beneficial effects are summarized of heated discharges to the fish population of inland reservoirs in Texas. The sample fish were cultured in a discharge canal for three months. A net increase in weight over 400% in a cage of small test fish in 62 days was observed. In the control pond (with no temperature increase) the fish sample showed no increase in weight. The experiment was performed in January 1970. The control fish were fed but they would consume feed only when several days of warm air temperatures increased pond water temperatures. (Novotny-Vanderbilt)
W71-04434

TRENDS IN THERMAL POLLUTION CONTROL REQUIREMENTS,
Water Pollution Research and Applications, Inc., Washington, D.C.
J. I. Bregman.
Cooling Tower Institute semi-annual meeting, Aspen, Colorado, June 22-24, 1970. 13 p.

Descriptors: *Thermal pollution, Water quality standards, Mixing, Temperature, Temperature effects, Fisheries, Fish populations, Rivers, Streams, Lakes.

There are basically four types of temperature standards in various states. (a) the imposition of the absolute temperature value (maximum temperature), (b) allowable change in the temperature from what it would be without the artificial addition of heat, (c) gradual progression of temperature, (d) mixing some standards. These standards are discussed in regards to fish and fresh water organisms. Some waters exist which are designated to allow no changes from natural conditions. (Waters used as cold water fisheries), in the case of cold water fisheries, most states have established 68F as the maximum allowable temperature and from zero to 5F, with 2F being the usual value, as the maximum allowable increase above background. For warm water fisheries, the maximum allowable temperatures are generally in the range of 83 to 93F and the maximum allowable rise is above 5F. Some special cases of river standards are discussed. (Novotny-Vanderbilt)
W71-04435

THERMAL POLLUTION: A SURVEY OF CAUSE AND EFFECT,
Midwest Research Inst., Kansas City, Mo.
Michael C. Noland.
Midwest Research Institute, Kansas City, Missouri, MRI paper No 918, Presented at the Bi-Annual Meeting of the Cooling Tower Institute, Houston, Texas, January 20-22, 1969. 21 p, 11 ref.

Descriptors: Thermal pollution, Thermal power plants, Temperature, Temperature effects, Rivers, Reservoirs, Cooling water, Heat, Heat balance, Waste water (Pollution).

The discharge of heated water into streams or reservoirs can have a serious effect on the quality of the water with which it is mixed. Approximately 80% of the water used by industry in the USA is used as cooling water. Sources of heated discharges are discussed in the paper. Heated discharges can affect the quality mainly as (1) the influence on the ability of the water to carry and assimilate waste, and (2) the effect on the biodynamic balanc aquatic life forms. Not all effects of the discharges are determined. Possible approache the solution of thermal pollution problems proposed. (Novotny-Vanderbilt)
W71-04439

THE DIET AND INFECTION OF FISHES CAVENDISH DOCK, BARROW-IN-FURNES
Central Electricity Generating Board, London gland).
S. Markowski.
J Zool, Lond, No 150, p 183-197, 1966. 1 fig, 8 16 ref.

Descriptors: *Thermal pollution, Temperat Salinity, Fish diets, Infection, Docks, Zooplank Ecology, Fish, Trematodes, Worms, An parasites, Fish parasites, Fish diseases.
Identifiers: Cavendish Dock, Feeding habits.

Some 934 fishes belonging to 10 species were amined in Cavendish Dock, Walney Channel ar the River Dudden in order to study their diet infection. The water in Cavendish Dock is part heated by power station cooling water. Chang salinity affect the specific composition of an populations and raised temperature promotes growth of organisms in this water reservoir. diet and thus the infection of fishes are influe by these two factors. The salinity of the dock w ranges from 1.3 percent in March to 14.3 per in August. The temperatures of the water in the heated part of the dock varied between 7.8C 18C and in the heated side between 11.2C 23.5C. As the 300 plankton had practically di peared, the diet of the dock fishes during thi vestigation was composed of benthic organi This restricted section in feeding apparently not affect the growth of fishes in Cavendish D Fifteen different species of parasitic worms bel ing to Trematoda, Cestoda, Nematoda Acanthocephala were recorded in fishes exami In Cavendish Dock only 18 fishes were infected of 305 examined. The infection of P. flesus in ney Channel is composed of eight species parasitic worm. Even during these investigati signs of change in the animal population was fo (Upadhyaya-Vanderbilt)
W71-04441

EFFECTS OF MARINE SEWAGE DISPOSAL
Water Pollution Research Lab., Stevenage gland).
For primary bibliographic entry see Field 05E.
W71-04491

POSSIBLE TOXIC EFFECTS OF CYANA THIOCYNATES, FERRICYANIDES, FER CYANIDES AND CHROMATES DISCHARG TO SURFACE WATER,
Montgomery Research Inc., Pasadena, Calif.
R. G. Zehmpfenning.
Proceedings, 22nd Industrial Waste Confere May 2, 3, 4, 1967, Purdue University, Vol LII, 3, p 879-883, July 1968. 30 ref.

Descriptors: *Toxicity, Chromium, Aquatic Hydrogen ion concentration, Alkalinity, Chlor tion, Waste water treatment, Toxins.
Identifiers: *Cyanates, *Thiocyanates, *Ferri nides, *Ferrocyanides, *Chromates, *Ph graphic wastes.

A study was conducted to assess the possible fects of the disposal of treated or untreated ph graphic process wastes either to flowing sur water or to lagoons overlying impervious for tions with respect to public health, beneficial of water and aquatic life. The study is concer not only with the effects of the waste material discharged, but also with interactions which occur between the various components or with effect of light on development of toxicity. (E Texas)
W71-04501

TRATES IN PLANTS AND WATERS,
sconsin Univ., Madison. Dept. of Soil Science.
primary bibliographic entry see Field 05B.
1-04523

VIVO ASSIMILATION BY COD MUSCLE D LIVER TISSUE OF ELEMENTAL OSPHORUS FROM POLLUTED SEA TER,
eries Research Board of Canada, Halifax va Scotia). Halifax Lab.
. Dyer, D. F. Hiltz, R. G. Ackman, J. Hingley, G. L. Fletcher.
nal Fisheries Research Board of Canada, Vol No 6, p 1131-1139, 1970. 2 fig, 4 tab, 8 ref.

criptors: *Absorption, *Phosphorus, *Water ution effects, *Sea water, Marine animals, ds, Toxicity, Gas chromatography, Tempera- Distribution, Sampling.
tifiers: *Cod, Muscle, Liver, Elemental phorus.

ental phosphorus is known to be toxic to man other animals and there are demonstrated in- es of toxicity of colloidal elemental phorus to a freshwater fish species and to a ater animals. Cod rapidly assimilates elemen- hosphorus from sea water into their tissues. In -hour exposure to a concentration of 20-80 phosphorus was concentrated a 1000-fold in iver (even more at lower exposure levels), 10-25 times in white muscle, and about 50- times in red muscle. This distribution is ly in proportion to lipid content and is rm throughout the white muscle of the fillet, facilitating sampling. This remarkably rapid e of elemental phosphorus by cod has been reted as absorption through the gills into the latory system. Even low levels of elemental horus must be considered dangerous in a al environment if fish are exposed for more a few hours. The very efficient concentration mental phosphorus into the liver suggests that sis of depot fat, organs such as liver of fish l provide the most sensitive indication of le exposure to elemental phosphorus in sea- environment. (Jones-Wisconsin)
04524

TRIBUTION TO THE EPIPHYTIC ALGAL A OF THE LAKE NEUSIEDLER, (IN GER-
a Univ. (Austria). Botanisches Institut und ischer Garten.
imary bibliographic entry see Field 02H.
04526

EMPORARY CONCEPT OF THE BIO- RE, (IN RUSSIAN),
emiya Nauk SSSR, Moscow.
Kovda.
al Obschchei Biologii, Vol 30, No 1, p 3-17, 2 tab, 6 ref.

ptors: *Ecosystems, *Aquatic environment, ace of nature, Photosynthesis, Organic , Food chains, Productivity, Wastes, lankton, Energy, Radiation, Pesticides, pollution sources, Biomass, Proteins, rganisms.
iers: *Hydrosphere, *Biosphere, Food s, Protein sources, Biogenic matter, Food ial.

ndensed survey of the animated segments of rth devotes particular attention to the tive potential of the hydrosphere. Aquatic photosynthesize about 45% of the world's amount of organic matter. The annual tion of oceans varies from 36 to as much as am carbon per square meter. This output is ted with the quotients of utilizable radiation , ranging from 0.02 to 0.33%. The latter um efficiency of the hydrosphere coincides hat of forest stands. The present annual tion of proteins is about 50% short of the supply required to eliminate the obvious and the concealed starvation of the world's population. There is a hope to supplement the future diet by microorganisms, including those of the hydrosphere. Materialization of this possibility depends on the rigid control of factors disrupting the productive efficiency of aquatic ecosystems, such as promiscuous use of pesticides and discharge of untreated domestic or industrial effluents. (Wilde-Wisconsin)
W71-04527

MOLECULAR STRUCTURE AND HERBICIDAL ACTIVITY OF SOME SUBSTITUTED UREAS,
Department of Agriculture, Saint-Jean (Quebec). Research Station.
For primary bibliographic entry see Field 03F.
W71-04534

THE MACROBENTHOS OF THE PAMLICO RIVER ESTUARY, NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh; and North Carolina State Univ., Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 02L.
W71-04540

BIOCHEMICAL OXIDATION OF HYDROCARBONS IN NATURAL WATERS,
Rhode Island Univ., Kingston. Dept. of Bacteriology.
For primary bibliographic entry see Field 05D.
W71-04543

BIOLOGICAL FIXATION AND TRANSFORMATION OF NITROGEN IN SMALL IMPOUNDMENTS,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W71-04544

HAZARDS OF MERCURY.

Special Report of Study Group on Mercury Hazards to Secretary's Pesticide Advisory Committee, Department of Health, Education and Welfare, November 1970. 97 p, 2 fig, 9 tab, 128 ref, 3 append.

Descriptors: *Water pollution effects, *Path of pollutants, *Hazards, *Poisons, *Heavy metals, Water quality, Water pollution sources, Public health, Chemical wastes, Organic compounds, Safety, Monitoring, Human pathology.
Identifiers: *Mercury, *Methylmercury.

The problem of mercury contamination in the United States is potentially grave. The problem has been under intensive study for some years in Sweden and Finland where the patterns of usage of mercury are similar to those in the United States. The present situation stems from the extensive recent increase in the industrial and agricultural uses of mercury. Methylmercury is concentrated several thousand times in fish and shellfish, partly through contamination of their food and partly through its presence in the water. The relative ease with which methylmercury passes the 'blood-brain barrier' accounts for severe neurologic manifestations. The sources of mercury contamination, which caused a recent poisoning disaster in Minamata Bay and Niigata, Japan, were discharges from plants using mercury catalysts in the manufacture of vinyl chloride and acetaldehyde. Methylmercury was preformed in the effluent of these factories. This report is an assessment of hazards of mercury as of mid-1970. It contains many specific recommendations aimed at better understanding and solution of the mercury problem in the United States. (Knapp-USGS)
W71-04558

HYDROGEOCHEMICAL EFFECTS OF INJECTING WASTES INTO A LIMESTONE AQUIFER NEAR PENSACOLA, FLORIDA,
Geological Survey, Ocala, Fla.
For primary bibliographic entry see Field 05B.
W71-04578

TEMPERATURE AND WATER-QUALITY CONDITIONS OF THE PATUXENT RIVER ESTUARY, MARYLAND, JANUARY 1966 THROUGH DECEMBER 1967,
Geological Survey, Washington, D.C.
Robert L. Cory, and Jon W. Nauman.
Chesapeake Science, Vol 11, No 4, p 199-209, December 1970. 11 p, 12 fig, 12 ref.

Descriptors: *Remote sensing, *Thermal pollution, *Thermal powerplants, *Estuaries, *Maryland, Water temperature, Heated water, Path of pollutants, Water quality, Water pollution sources, Salinity, Tides, Tidal effects, Water circulation, Streamflow, Mixing.
Identifiers: *Patuxent estuary (Md).

The effect of power plant cooling water in raising natural water temperatures at a location near the power plant on the Patuxent River estuary is clearly evident from thermograph records. Surface temperature at a station 333 m downstream from the discharge canal was raised an average of about 4 C, and at times by as much as 8 C. Temperature rises were greatest during the winter. Infrared imagery showed that elevated surface temperatures could be detected about 5.5 km upstream at flood tide. Temperature profiles obtained from airborne radiation equipment revealed a complicated surface temperature pattern and also showed the effects of density differences and wind action on the steam-electric station effluent plume. Mean annual salinity for a 5-year period (1963-1967) was highest in 1966, about 12.3 parts per thousand, and lowest in 1967, about 9.9 parts per thousand. Dissolved oxygen values for 1966-1967 ranged from 3.2 to 15.6 mg/liter, and saturation ranged from 55 to 152%. Turbidity levels were inversely related to salinity, with the highest annual mean of 28 Jackson Candle Units occurring in 1967, the lowest salinity year. The extreme tide range was 2.1 m; mean water levels at the Patuxent Bridge were highest in summer and lowest in winter. Water stages are more affected by wind speed and direction than by flow in the river. (Knapp-USGS)
W71-04585

EFFECTS OF MINING POLLUTION ON VASCULAR PLANTS IN THE NORTHWEST MIRAMICHI RIVER SYSTEM,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
K. W. Besch, and Patricia Roberts-Pichette.
Canadian Journal of Botany, Vol 48, p 1647-1656, 1970. 5 fig, 3 tab, 15 ref.

Descriptors: *Mining, *Water pollution effects, *Rivers, Copper, Water pollution sources, Submerged plants, Riparian plants, Monocots, Dicots, Toxicity, Invertebrates, Surveys, Flow Hydrogen ion concentration, Grasses.
Identifiers: *Northwest Miramichi (Canada), Zinc, Equisetum arvense, Cyperaceae, Cardamine pensylvanica.

Effects of copper-zinc mining pollution on riparian and aquatic vascular plants were studied in the Northwest Miramichi River system of northern New Brunswick. After a period of 8 years, the riparian vascular flora of the river system's gravel shores has been completely eliminated or seriously reduced. The most sensitive plants are the submersed aquatic species, followed by riparian dicotyledons. Monocotyledons are less sensitive than dicotyledons and Equisetum arvense least susceptible species. A rough index of pollution severity was devised based on the absence of species or species groups which would normally be present under unpolluted conditions. The absence of some spring-flowering geophytes normally

present at the high-water line is believed to be caused by the large amounts of toxic metals accompanying the high spring flows. It is possible to distinguish three different degrees of severity of zinc-copper pollution in rivers and streams, according to the effects on the higher vascular flora. With extremely high pollution, trees and shrubs along the banks are killed; with medium to high pollution only a few species are present, mainly Cyperaceae, Cardamineae, and Equisetaceae; dicotyledons are absent. With low pollution only submerged vascular plants are eliminated. (Jones-Wisconsin)
W71-04619

CHRONIC MALATHION TOXICITY TO THE BLUEFILL (LEPOMIS MACROCHIRUS RAFINESQUE),
Federal Water Quality Administration, Duluth, Minn. National Water Quality Lab.
John G. Eaton.
Water Research, Vol 4, No 10, p 673-684, 1970. 7 tab, 23 ref. FWQA Program 18050 WAE 12/70.

Descriptors: *Pesticide toxicity, *Organophosphorus pesticide, *Bluegills, *Bioassay, Lethal limit, Life history studies, Spawning, Water pollution effects, Toxicity.
Identifiers: *Chronic toxicity, *Malathion toxicity, *Acute toxicity, Malathion, Flowing-water system, Acetylcholinesterase inhibition.

An evaluation is made of the usefulness of an application factor in predicting the chronic toxicity of the pesticide malathion. All life cycle stages of bluegills are exposed to several concentrations of malathion (66 to 0.66 microgram/liter) in a diluter-regulated, flowing water test system in order to identify safe (3.6 microgram/liter) and unsafe (7.4 microgram/liter) levels. The fish spawned in artificial nests while being held in the test chambers. Egg and fry stages were no more sensitive to malathion than older fish. Brain acetylcholinesterase determinations on fish still alive at the end of the chronic test revealed a reduction in activity of nearly 50% among fish exposed to levels considered unsafe, and a depression in activity of one-third the control in toxicant concentrations considered safe. Acute malathion toxicity is also determined for use in calculation of an application factor (chronic toxicity divided by acute toxicity). The resulting application factor for bluegills agrees very closely with one previously calculated for fathead minnows exposed to malathion, even though the long term toxicity of malathion to bluegills is more than 50 times that to fathead minnows.
W71-04666

SANTA BARBARA OIL POLLUTION, 1969, A STUDY OF THE BIOLOGICAL EFFECTS OF THE OIL SPILL WHICH OCCURRED AT SANTA BARBARA, CALIFORNIA, IN 1969,
California, Univ., Santa Barbara.
A. Foster, M. Neushul, A. C. Charters, and R. Zingmark.
Copy available from GPO Sup Doc as I67.13/4:15080 DZR 11/70, $0.55; microfiche from NTIS as PB-197 670, $0.95. Water Pollution Control Research Series 15080 DZR 11/70, October 1970. 49 p, 7 tab, 15 fig, 33 ref. FWPCA Program 15080 DZR.

Descriptors: Water pollution effects, *Water pollution sources, California, *Oily water, Oil wastes, Oil, Littoral, Remote sensing, Aerial photography, *Environmental effects, Intertidal areas, Aquatic habitats, Beaches.
Identifiers: *Santa Barbara (Calif), *Oil spillage, Oil spills, Kelp bed organisms, *Intertidal plants, *Intertidal animals.

The initial flow of oil that began on January 28, 1969, from an offshore oil platform deposited an estimated 4,500 metric tons of pollutant oil on nearly 90 kilometers of coast by February 8, 1969. Winds, wave action, tides, and substrate determined the pattern of the oil distribution in the intertidal zone. Heavy biological damage occurred in intertidal surf grass and barnacle populations as a result of the oil pollution. Based on earlier surveys, the greatest negative biological change at a sample station was the loss of 16 plant species. However, these losses in species were attributable in most cases to sand movement and other storm-associated events. The potential long-term biological effects of the continuing pollution are discussed. This report consists of the introductory material, two short papers, and general discussions. The first paper, The Santa Barbara Oil Spill, I. Initial Quantities and Distribution of Pollutant Crude Oils, deals with the amounts of stranded oil and its distribution. The second paper, The Santa Barbara Oil Spill, II. Initial Effects on Littoral and Kelp Bed Organisms, deals with the preliminary biological effects that we observed. A treatment of aspects of the Santa Barbara pollution problem that relates the authors observations to those of others, and considers the broader implications of marine pollution in general, has been incorporated in the discussion section.
W71-04670

SOCI-ECONOMIC FACTORS RELATED TO THE INCIDENCE OF WATER-BORNE DISEASE,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 05F.
W71-04675

THE EFFECT OF WATER QUALITY AND ENVIRONMENTAL FACTORS ON FRESHWATER FISH,
New Mexico State Univ., University Park. Dept. of Biology.
W. G. Whitford.
Available from NTIS as PB-197 676, $3.00 in paper copy, $0.95 in microfiche. Completion Report, (1970). 6 p, 1 ref. OWRR Project A-003-NMEX (1).

Descriptors: *Water quality, Temperature, Hardness, Acclimatization, Hydrogen Ion Concentration, *Fish, Thermal pollution, *Water temperature.
Identifiers: Green Sunfish, Oxygen content, *Thermal Tolerence.

Water temperatures of Rio Grande River ranged from 0C to 29C, pH ranged from 7.4 to 8.6, total hardness varied from 86 ppm in the upper river to 194 .. 6ppm in the reservoirs. The mean critical thermal maximum (CTM) was 39.9C in fish acclimated in fresh water (10-30ppm), 28.2C in fish acclimated in water at 85 ppm, 27.3C in fish acclimated at 171 ppm. Ion concentration of 180 ppm and 25 ppm has no effect on the CTM of the mosquito, fish, Gambusia affinis. The effect of water hardness on upper lethal temperature of the green sunfish Lepomis cyanellus acclimated at 20C and 30C and hardness levels of 30, 180, and 400 ppm indicated no significant effect of hardness on the incipient lethal temperature 35C for 20C acclimation and 40C for 30C acclimation. The relationship between incipient lethal temperature and acclimation is expressed by the equation, Log (LD50) — 1.322 .. .0056 (CTM in degree C). Incipient lethal of 31C for 10C acclimated fish was obtained. There was no difference in the critical oxygen tension in active fish and nonactive fish. At 20C acclimation the mean oxygen consumption was 0.177 ml/gm/hr. (Upadhyaya-Vanderbilt)
W71-04677

EFFECTS OF WARM WATER DISCHARGES ON SURFACE WATERS (IN GERMAN),
Bundesanstalt fuer Gewasserkunde, Coblenz (West Germany).
M. Eckold, H. Knopp, and H. J. Licbsher.
1969. 67 p.

Descriptors: *Thermal pollution, Temperature, Fishing, Navigation, Thermal power plants, Nuclear power plants, Cooling water, Self-purification, Waste assimulative capacity, Water po effects, Physical properties, Biological pro Heat resistance.

The study deals with the ability of streams or to accept and cool the heated discharges fro mal (nuclear) power plants. Such discharge about changes in physical and biological cor of receiving streams. The measures neces prevent harmful effects are discussed. The aimed at producing basic information for p and design of future nuclear and thermal plant locations in Germany. The followi discussed: physical and biological properti changes under the influence of heated disc sewage degradation or self purification, supply, industrial water supply, navigatio fishing. (Novotny-Vanderbilt)
W71-04718

UTILIZATION OF THERMAL WATER NUCLEAR POWER PLANTS,
National Council for Research and Develo Jerusalem (Israel).
George Kligfield.
Developments in Water Quality Re Jerusalem International Conference on Quality and Pollution Research, Jerusalem, p 173-178, June 1967. 6 fig, 1 ref.

Descriptors: *Nuclear power plants, *Ther fluents, *Heated waters, Irrigation, *Subsur rigation, *Food crops, Agriculture, Tempe Oregon.
Identifiers: Oregon's Willamet, Weyerh paper and pulp plant, McKenzie River.

An approach to the utilization of warm waters from a paper and pulp plant for agric benefits and demonstration of the concept mal enrichment as apposed to thermal poll presented in this paper. The procedure, wh compasses seven Oregon firms, began wi overhead sprinkling of warm water during phases of the growing season: early spr prevent freeze killing of fruitbuds, blosson early fruit; normal ground crop irrigation; an burn prevention during hot dry periods. A year program for demonstration of the eff heat energy contained in the irrigation wa ascertain if warm water has a more beneficial on air temperature, humidity, and soil tempe than does the application of normal (cool) r well water is given. Some conclusions are: (1 this project aims at determining methods troducing heat to soil, well and subsurface tion will be coupled with mulching techniqu the tying together of nuclear power and a tural promises major economic benefits; a ponding, or a cooling lake, can be the key utilization of this water in the creation o population centers and can provide as well, pered irrigation water supply. (Herren derbilt)
W71-04723

RELATION BETWEEN THE 'ITAI-ITAI EASE AND THE POLLUTION OF R WATER BY CADMIUM FROM A MINE,
Okayoma Univ., Kurashiki (Japan). Ohara In Agricultural Biology.
J. Kobayashi.
5th International Water Pollution Research ference, Pap I-25, San Francisco, California August 1970. 6 fig, 3 tab, 2 ref.

Descriptors: *Heavy metals, *Metals, drainage, *Diseases, *Human pathology, Ino compounds, Water pollution effects, Mine w Mining, Water pollution, Human diseases, health, Epidemiology, Toxicity.
Identifiers: *Cadmium, Cadmium effects, C um pollution, Metals effects.

As a consequence of the discovery of a high tent of Cd, Zn, and Pb in the tissues of the p suffering from the itai-itai disease, which app

a restricted district along the Jintsu River in yama Prefecture, Japan, there was a presumption that the cause of the disease was chronic isoning by the heavy metals found in the waste ter from a mine upstream. The following obser-ions were made: (1) The itai-itai disease and nage to rice by the waste water appeared in the ne place along the banks of the river during the ne period. (2) A heavy accumulation of Cd and er metals was found in the patient's bones, inter- organs, soil, and plants. (3) In animal experi-nts on rats it was proved that the rats fed by Cd reted more Ca than that assimilated from the d while the control group showed the opposite nomena. From these results, it was made clear the itai-itai disease was induced by cadmium in waste water from the mine. (Novotny-Van-bilt)
1-04726

ME MICROBIAL-CHEMICAL INTERAC-NS AS SYSTEMS PARAMETERS IN LAKE E,
State Univ., Columbus. Microbial and Cellu-Biology.
primary bibliographic entry see Field 06A.
-04758

URCHIN POPULATION EXPLOSION IN THERN CALIFORNIA COASTAL TERS,
fornia Inst. of Tech., Pasadena. W. M. Keck of Engineering Materials.
eler J. North, and John S. Pearse.
nce, Vol 167, No 3915, p 209, January 9, . 5 ref.

riptors: *Sewage, *Aquatic life, *Populations, r pollution effects, Sewage effluent, Effluents, systems, Ecology, California, Environmental ts, Coasts.
ifiers: *Sea urchins, California coastline, population, Human population, Coastal pollu-

rnia coasts are experiencing the effects of the population of the sea urchin, Strongylocen-s. The environmental changes that caused this population were wrought by man. Water en-ient by sewage effluents caused elimination of etitors and predators allowing the sea urchins erpopulate. This abundance of sea urchins is nting the growth of vegetation and kelp, by, upsetting the ecosystem. (Ensign-PAI)
04795

D TOXICITY STUDIES AND JUVENILE ION DISTRIBUTION IN PORT ANGELES BOR, WASHINGTON,
ington State Water Pollution Control Com-n, Olympia.
es D. Ziebell, Roland E. Pine, Alvin D. Mills, ichard K. Cunningham.
h, German, Spanish and Portuguese ab-. Journal Water Pollution Control Federa-Vol 42, No 2, p 229-236, February 1970. 3 ab, 9 ref.

iptors: Water quality, *Pulp wastes, *Toxici-dge, *Sulfides, *Salmon, Washington, Lethal Fish toxins, Industrial wastes, Water pollution , Harbors.
iers: *Port Angeles Harbor (Wash), Coastal on.

dy was made in Port Angeles Harbor, ngton, to determine the water quality condi-nd the effects of pulp mill waste discharges condition and distribution of juvenile Pacific . Sulfides from the anaerobic decomposition dge deposits in the bottom of the harbor d to be the primary cause of toxicity. Sulfide of 0.3 mg/l were toxic to juvenile salmon but were noticed at levels of 0.1 and 0.2 mg/l. tages also influenced the level of toxicity. n-PAI)
4796

EFFECT OF PULP MILL EFFLUENT ON FAUNA OF SEA LOCH,
Dunstaffnage Marine Research Lab., Oban (Scotland).
T. H. Pearson.
Marine Pollution Bulletin, Vol 1, No 6, p 92-94, June 1970. 3 fig, 2 tab, 5 ref.

Descriptors: *Industrial wastes, *Pulp wastes, *Aquatic animals, Water pollution effects, Monitoring, *Benthic fauna, Benthos, Effluents.
Identifiers: Linnhe Loch, Eil Loch, Scotland, Coastal pollution.

The decision to erect an integrated pulp and paper mill which would discharge its wastes into the narrows between lochs Linnhe and Eil on the west coast of Scotland prompted establishment of a monitoring survey of the hydrographical and biological conditions to assess effects of the discharge. Bi-monthly samples of the hydrographical conditions and detailed sampling of the benthic and infauna of the lochs are included. (Ensign-PAI)
W71-04797

SOME BIOLOGICAL EFFECTS OF OIL POLLUTION,
Orielton Field Studies Centre. Oil Pollution Research Unit.
Eric B. Cowell.
Your Environment, Vol 1, No 3, p 84, 93-94, Summer 1970.

Descriptors: *Water pollution effects, Oil, *Ecosystems, *Toxicity, *Cleaning, Seepage, Accidents, Detergents.
Identifiers: Limpets, Seaweed control, Population imbalance, *Oil pollution.

Investigating the biological effects of oil pollution and the following shore cleaning operations is complex because the ecosystem is a system of inter-related reactions between the abiotic environment and the organisms that are dependent upon it. It is established that the volatile aromatic compounds in crude oil are the most toxic to wildlife, yet further damage can be done by the detergent/emulsifier beach cleaning methods. If in the process of beach cleaning only one species is killed in sufficient numbers then the ecological chain reaction that follows will ensure wide spread damage to the system and recovery will be slow. These problems with specific examples are presented in detail. (Ensign-PAI)
W71-04802

ANNULMENT AZIRIDINE (APHOLATE) - INDUCED GROWTH INHIBITION IN THE ESTUARINE FLAGELLATE TETRASELMIS SUBCORDIFORMIS BY SOME PURINES AND PYRINIDINES,
Bureau of Sport Fisheries and Wildlife, Highlands, N.J. Sandy Hook Marine Lab.
J. C. Prager, and J. B. Mahoney.
Journal of Protozoology, Vol 16, No 1, p 187-190, 1969. 1 fig, 2 tab, 26 ref.

Descriptors: *Estuaries, *Pesticides, Invertebrates, *Toxicity, Aquatic animals, *Sterilants.
Identifiers: *Marine flagellates, Tetraselmis subcordiformis, *Aziridines.

An insect chemosterilant at 850 ppm apholate reduced growth of the marine flagellate Tetraselmis subcordiformis by 50% in 21 days. Two other aziridinyl chemosterilants tested were more toxic than apholate-values agreeing with those for some estuarine animals. Apholate acted directly on the organisms. Comparatively small molar additions of orotic acid, adenine, guanine and thymine to apholate-poisoned cultures annulled the growth inhibition. Mode of action of aziridinyl chemosterilants by activity annulment is also discussed. (Ensign-PAI)
W71-04806

OYSTERS AND HUMAN VIRUSES: EFFECT OF SEAWATER TURBIDITY ON POLIOVIRUS UPTAKE AND ELIMINATION,
Gulf Coast Water Hygiene Lab., Dauphin Island, Ala.
Frederick E. Hamblet, William F. Hill, Jr., Elmer W. Akin, and William H. Benton.
American Journal of Epidemiology, Vol 89, No 5, p 562-571, May 1969. 2 fig, 6 tab, 28 ref.

Descriptors: *Water pollution effects, *Viruses, *Oysters, *Human diseases, *Turbidity, Water purification.
Identifiers: *Poliovirus, Uptake, Elimination, Crassostrea virginica, Coastal pollution.

The effect of turbidity, in a flow-through seawater system, on Oyster accumulation and elimination of poliovirus was studied. Data indicated that in the virus accumulation stage oysters in low turbidity seawater (16-24 ppm) over a 24 hour period accumulated about three times as much virus (PF U/ml) as those oysters in high turbidity seawater (S4-77 ppm). Turbidity (8-80 ppm) did not significantly influence virus elimination in oysters in the 24 hour period. In 48 hours no virus was found in the oysters. It is concluded that oysters in continuously flowing seawater of either high or low turbidity can eliminate virus in 48 hours in a controlled environment. (Ensign-PAI)
W71-04808

IMPLICATION OF A MARINE AMEBA IN THE DECLINE OF ESCHERICHIA COLI IN SEAWATER,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
Ralph Mitchell, and Shlomit Yankofsky.
Environmental Science and Technology, Vol 3, No 6, p 574-576, June 1969. 3 fig, 12 ref.

Descriptors: Water pollution effects, *Microorganisms, *Biodegradation, Populations.
Identifiers: *Lysis, *Escherichia coli, *Vexillifera telmathalassa, Marine ameba.

Escherichia coli decline in seawater and the increase of a specific microbial population capable of causing lysis of the intestinal bacteria was observed. Pure cultures of the marine ameba were obtained and the organism was identified as Vexillifera telmathalassa. Adding this marine ameba to natural seawater with E. coli resulted in a rapid kill of the intestinal bacterium. The decline of intestinal bacteria in the sea and the importance of the marine microflora is discussed. (Ensign-PAI)
W71-04811

LEVELS OF STABLE ZN AND 65ZN IN CRASSOSTREA VIRGINICA FROM NORTH CAROLINA,
Bureau of Commercial Fisheries, Beaufort, N.C. Radiobiological Lab.
Douglas A. Wolfe.
Journal of the Canada Fisheries Research Board, Vol 27, No 1, p 47-57, January 1970. 2 fig, 3 tab, 36 ref.

Descriptors: *Radioactive wastes, *Zinc radioisotopes, Shellfish, *Oysters, *Estuaries, North Carolina.
Identifiers: Crassostrea virginica, *Zinc.

An investigation of zinc concentration in oysters in relatively unpolluted estuaries in North Carolina demonstrated high variability. Internal tissues such as the adductor muscle and pericardial sac, had zinc levels less than half those of external tissues. North Carolina oysters contained 2-20pCi 65Zn from fallout per 100g wet weight during the period from 1964-66. From 1965-66 specific activity of 65Zn in these oysters was from 90-300pCi/g Zn, and was declining. (Ensign-PAI)
W71-04812

OIL IN THE ECOSYSTEM,
Robert W. Holcomb.

Science, Vol 166, No 3902, p 204-206, October 10, 1969.

Descriptors: *Oil wastes, *Water pollution effects, *Aquatic life, *Ecology.

Pollution of the marine environment by oil spills is more threatening than ever with the prospect of more oil being transported longer distances in larger tankers. Little is known about the handling of oil spills or the effects of oil on the environment. Birds suffer mortality in high numbers, and entire animal populations have been eradicated from certain areas, but more research is needed. Various programs to study ecology are underway on an international scale in the hopes of finding a solution to the oil problem. (Ensign-PAI)
W71-04813

DISSOLVED FREE AMINO ACIDS IN SEA WATER AND THEIR CONTRIBUTION TO THE NUTRITION OF SEA URCHINS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
Mary E. Clark.
California Institute of Technology, Pasadena, W. M. Keck Laboratory of Environmental Health Engineering. Annual Report, Chapter 6, p 70-93, July 1968 - June 1969. 2 fig, 7 tab, 48 ref.

Descriptors: *Sewage, *Outlets, *Nutrients, *Amino acids, *Marine animals.
Identifiers: *Sea Urchins, Glycine, Serine, Alanine, Aspartic acid.

A study of the dissolved free amino acids in sea water from the Los Angeles Basin and uptake rates of the four major amino acids by a local species of urchins Strongylocentrotus purpurats is presented. The method of DFAA Analysis, actual DFAA concentrations found, and the contribution which glycine, serine, alanine and aspartic acid make to the nutrition of the urchins is described. Approximately 50% of the daily nutrient requirements for urchins living near sewage outfalls can be fulfilled by uptake of the DFAA. (Ensign-PAI)
W71-04814

STRONTIUM-90 AND CESIUM-137 LEVELS IN TISSUES OF FIN WHALE (BALAENOPTERA PHYSALUS) AND HARP SEAL (PAGOPHILUS GROENLANDICUS),
Department of National Health and Welfare, Ottawa (Ontario). Radiation Protection Div.
E. R. Samuels, M. Cawthorn, B. H. Lauer, and B. E. Baker.
Canadian Journal of Zoology, Vol 48, No 2, p 267-269, March 1970. 1 tab, 10 ref.

Descriptors: *Mammals, *Radioisotopes, *Strontium radioisotopes, *Cesium, Water pollution effects.
Identifiers: *Whales, *Seals.

Strontium-90 and Cesium-137, in eleven different tissues of the fin whale and two tissues of the harp seal were identified. The highest concentration of strontium-90 was found in whale blubber. Muscle tissue seemed to contain more Cesium-137 than did the other tissues. The average concentration of Cesium-137 in whale muscle was 4.5 Ci/g ash and in adult seal muscle was 2.5 pCi/g ash. (Ensign-PAI)
W71-04817

SALMONELLA TYPES ISOLATED FROM THE GULF OF AARHUS COMPARED WITH TYPES FROM INFECTED HUMAN BEINGS, ANIMALS, AND FEED PRODUCTS IN DENMARK,
Aarhus Univ. (Denmark). Inst. of Hygiene.
K. Grunnet, and B. Brest Nielsen.
Applied Microbiology, Vol 18, No 6, p 985-990, December 1969. 3 fig, 4 tab, 16 ref.

Descriptors: *Waste water disposal, Pollutants, *Bacteria, Food chains.
Identifiers: *Salmonella, Gulf of Aarhus, Denmark.

The Gulf of Aarhus, which receives waste water from industries and from 100,000 inhabitants was investigated for Salmonella over a two year period. Distribution of Salmonella types in the Gulf of Aarhus and in Oeresound, from 1966 to 1968 and the distribution in man, animals, and foodstuffs during the time from 1960 to 1968 in Denmark as a whole are shown. The classical chain of infection feedstuffs-animals-food-man is not indicated in Denmark. Though there are a great many human cases, the examined types of Salmonella were not found in animals or foodstuffs during this period. Qualitative Salmonella examinations to supplement the E. coli counts when examining polluted waters is suggested. (Ensign-PAI)
W71-04821

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE,
National Marine Water Quality Lab., West Kingston, R.I.
Clarence M. Tarzwell.
Abstracts in German, Portuguese and Spanish. Journal Water Pollution Control Federation, Vol 42, No 5, p 824-828, May 1970.

Descriptors: Water quality control, *Temperature control, *Oxygen requirements, *Aquatic life, Animal metabolism, Seasonal, Temperature, *Thermal pollution.
Identifiers: Temperature effects, Population imbalance, Spawning, Nest-building fish.

Temperature and oxygen must be considered in determining water quality requirements because aquatic organisms are cold-blooded and their metabolism is dependent on the temperature of the water. Through long periods of development these organisms adjusted to certain temperatures and daily and seasonal fluctuations in temperature. In setting temperature criteria, it is desirable to have a nationwide standard, and to maintain these fluctuations. The National Technical Advisory Committee of Water Quality Requirements for Aquatic Life indicated uniform allowable increase above the monthly average of the daily maximum temperatures. These increases are influenced by season, the most sensitive species and life stages in the biota, and the main taxonomic groups present. Temperature control is important to the abatement and control of pollution as well as conserving our aquatic life resources. (Ensign-PAI)
W71-04823

WHAT OIL DOES TO ECOLOGY,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
Charles T. Mitchell, Einar K. Anderson, Lawrence G. Jones, and Wheeler J. North.
Abstracts in French, German and Spanish. Journal Water Pollution Control Federation, Vol 42, No 5, p 812-818, May 1970. 8 fig, 7 ref.

Descriptors: Water pollution effects, Oil, *Seepage, *Ecosystems, *Toxicity, Animal populations, Plant populations, Ecology.
Identifiers: Tampico spillage, Santa Barbara spillage, Community changes, Population imbalance, Kelp, *Oil pollution.

Criteria for evaluating ecological consequences are presented and the observations of two spillages are explained in terms of the biological effects of exposure to oil. The Tampico spillage of diesel fuel in a cove on the Coast of Mexico in 1957 produced definable changes for approximately 5 miles. The Santa Barbara spillage of crude oil affected certain bird species but did not cause significant mortalities among intertidal and shallow subtidal organisms. These two accidents indicate that the ecological reactions to oil spillage vary with the character of the pollutant, the oceanographic conditions and the extent of the success of cleanup operations. (Ensign-PAI)
W71-04824

EFFECTS OF POLLUTION ON ESTU ECOSYSTEMS I. EFFECTS OF EFFL FROM WOOD-PROCESSING INDUSTRI THE HYDROGRAPHY, BOTTOM AND OF SALTKALLEFJORD (W. SWEDEN),
Institute of Marine Research, Helsinki (Finl
Pauli Bagge.
Findland. Merentutkimoslaitoksen Julkais sforskningsinstitutets Skrift No 228, p 3-18 23 tab.

Descriptors: *Estuaries, *Effluents, *Wood *Pulp and paper industry, *Hydro *Ecosystems, *Benthic fauna, Water pollu fects.
Identifiers: *pH, *Oxygen content, *BOD, parency.

The hydrography, bottom and fauna of the Fjord, Sweden were studied from 1964- fluents from a sulphite pulp and paper m discharged into Satlkallefjord, the centra area, for over 80 years. Sewage from near munities was also discharged into the fjord. content, pH, chemical and biochemical oxy mand and transparency were all effected. P effects on the fauna were both quantitative, tribution of the communities and qua decreased diversity of the fauna in pollute (See also W71-04827) (Ensign-PAI)
W71-04826

EFFECTS OF POLLUTION OF ESTU ECOSYSTEMS II. THE SUCCESSION O BOTTOM FAUNA COMMUNITIES IN LUTED EXTUARINE HABITATS IN TH TIC-SKAGERAK REGION,
Institute of Marine Research, Helsinki (Finl
Pauli Bagge.
Findland. Merentutkimuslaitoksen Julkais sforskningsinstitutets Skrift No 228, p 1 1969. 5 fig, 2 tab, 12 ref.

Descriptors: *Estuaries, *Effluents, *Eco *Benthic fauna, *Water pollution effects, tors.
Identifiers: *Salinity.

In five polluted estuaries, representing salinity ranges, in the Baltic-Skagerak ar parisons of the macrofaunal communities vestigated. The secondary succession of th communities due to pollution was very ra ticularly where the exchange of water is li ice-cover, sills, or poor circulation. Aquati isms as indicators of the degree of polluti clean water is discussed. (See also W71 (Ensign-PAI)
W71-04827

BOTTOM FAUNA IN A SEA NORTHWEST OF HELGOLAND, SEL FOR INDUSTRIAL WASTE DISPOSA GERMAN),
Konrad Stripp, and Sebastian Gerlach.
Bremerhaven, Institut Fuer Meeresfo Veroeffentlichungen, Vol 12, No 2, p 1 1969. 4 tab, 5 ref.

Descriptors: *Industrial wastes, *Waste *Bottom fauna.
Identifiers: *Sulfuric acid, *Ferrous s North Sea, Helgoland.

In 1967 and 1968, benthos stations in the disposal of industrial wastes containing s acid and ferrous sulphate were investigat van-Veen-grabs. The area selected near H belongs to the Venus-gallina-community w an average of 375 macrofauna individuals The more productive Echinocardium-co Amphiura-filiformis-community is appro one nautical mile to the southwest. Beca residual currents are directed toward the n this region should not be affected by the p (Ensign-PAI)
W71-04828

ARINE KILL ON NEW JERSEY WRECKS,
Ogren, and James Chess.
rwater Naturalist, Vol 6, No 2, p 4-12, 1969.
2 tab.

riptors: *Ships, *Accidents, *Fishkill, *Mor-
*Ecology.
ifiers: Submerged shipwreck.

ubmerged wrecks near Bay Head, New Jersey
the focal points of a massive fish kill in Sep-
r 1968. Mortalities were reported for seven
and effected fish, lobsters, crabs, starfish,
and mussels. Several environmental im-
es occurred preceding this event which may
not be related to the kill. (Ensign-PAI)
04836

ICAL AND CHEMICAL FACTORS AF-
NG VASCULAR AQUATIC PLANTS IN
ACID STREAM DRAINAGE AREAS OF
MONONGAHELA RIVER,
Virginia Univ., Morgantown. Dept. of Biolo-

loore, and R. B. Clarkson.
dings, West Virginia Academy of Science,
, p 83-89, 1967. 2 tab, 15 ref. OWRR A-005-
(2).

ptors: *Aquatic plants, *Acid mine water,
r pollution effects, *Rooted aquatic plants,
erged plants, Water pollution, Aquatic
Cattails, Floating plants, Pondweeds,
Aquatic life, West Virginia, Water quality.
iers: *Vascular aquatic plants, Monongahela
asin.

dy areas were established on three acid
ater polluted rivers in West Virginia--the
gahela, Tygart Valley, and West Fork. The
reas included four areas containing vascular
plants and two areas devoid of such plants.
rea was analyzed chemically for nitrogen,
ate, calcium, total acidity, iron, and pH.
l factors studied were the composition of
strate, the velocity of the water and the fluc-
of the water level. From a stepwise dis-
nt analysis comparing areas of plants with
levoid of plants, nitrogen, calcium, total
iron, pH and water velocity were deter-
o be non-limiting and statistically insignifi-
ubstrate was determined to be the primary
l factor in determining plant distribution.
ate and water fluctuation also were signifi-
ee also W71-04418)
850

Waste Treatment Processes

OPMENT OF DESALINATION MEM-
S,
Aniline and Film Corp., Easton, Pa. Cen-
earch Lab.
nary bibliographic entry see Field 03A.
426

Y OF THE ION EXCHANGE PROCESS
SALINATION APPLICATIONS.
Systems Research, Inc., Arlington, Va.
nary bibliographic entry see Field 03A.
429

NG TOWERS Q AND A.
n Inst. of Chemical Engineers, New York.
ommittee.

l Water Engineering, Vol 7, No 11, p 19-
1970.

ors: *Cooling towers, *Water cooling, Ion
e, Thermal pollution, Waste water treat-

rs: *Polyphosphates, *Chromate recovery,

Three main topics are considered: blowdown and make up, air cooling, and corrosion control in the tower. Due to its simplicity, continuous blowdown through an overflow in the cooling tower cold-water basin is usually employed. A change in the basin water level, controlled by the makeup water-float value, regulates the amount of blowdown. The oil and scum floating on the surface of the water is continuously removed from the system, but no provisions are made for sludge removal. It is said that 70-80% of excess plant heat in new petroleum refineries, petrochemical and natural gas processing plants is removed at a level favorable for air cooling. Ion exchange can be used for zinc-chromate blowdowns as well as for blowdowns free of zinc. (Herrera-Vanderbilt)
W71-04436

COOLING TOWERS, THE ENVIRONMENT AND THE FUTURE,
IIT Research Inst., Chicago, Ill.
Eric Aynsley.
Cooling Tower Institute Meeting, Snowmass-at-Aspen, Colorado, June 22-25, 1970. 12 p, 5 fig, 3 ref.

Descriptors: Cooling towers, Cooling, Thermal pollution, Air-pollution effects, Atmosphere pollution, Pollutants, Evaporation, Heat, Heat pollution.

The paper deals with the use of natural draft cooling towers for cooling of process water and their effects on the environment. The use of the draft cooling towers has increased exponentially since 1962 when the first one was put into operation. IIT Research Institute has completed a study of tower emissions and possible related environmental effects. Hyperbolic tower have much larger point emissions of heat and water vapor and have the potential to form dense, extensive fogs. Mixing of the tower and stack plumes was confirmed. There are a number of effects, mechanisms and interactions occurring both with cooling tower plumes and tower plumes mixed with nearby stack emissions. Some problems concerned with the salt emission from cooling systems using sea water for cooling are pointed out. (Novotny-Vanderbilt)
W71-04440

COOLING TOWER APPLICATION,
Kohloss (Frederick H.) and Associates Inc., Honolulu, Hawaii.
Frederick H. Kohloss.
American Society of Heating, Refrigerating and Air-Conditioning Engineers Journal, p 49-52, Aug 1970. 3 fig, 1 tab.

Descriptors: Cooling towers, Air conditioning, Structures, Water treatment, Performance, Water cooling, Waste water treatment.
Identifiers: Blow-through, Capacity, Air flow.

Cooling towers permit recirculation and reuse of water which has picked up heat, in a refrigeration condenser or other device, by having atmospheric air contact the water, and by evaporating a little of water to cool the rest of it. Among the types of smaller cooling towers available, the application engineers choice is dictated by performance, weight, height, power consumption, noise, building code requirements, fire code requirements, and most of all capital cost. If a tower is not level, performance will probably suffer from uneven distribution of water through the fill. Structurally adequate may be too limber to avoid vibration transmission. This can be overcome by soft-spring mounts with large deflections. Blow-through tower design is extremely susceptible to non-uniform airflow. Chemical analysis of water should be known in order to preplan the bleed rate. Usually on larger systems, water treatment for control of pH, a corrosion inhibitor, scale control, and biocides are all employed. Restriction of airflow at the cooling tower inlet and discharge are the major cause of reduced tower capacity. Many published applications recommendations suggest a design wet bulb temperature equaled or exceeded for 5% of the hours of the few hottest months of the year. (Upadhyaya-Vanderbilt)
W71-04442

MICROPROBE TECHNIQUES FOR DETERMINING DIFFUSIVITIES AND RESPIRATION RATES IN MICROBIAL SLIME SYSTEMS,
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
H. R. Bungay, W. J. Whalen, and W. M. Sanders.
Biotechnology and Bioengineering, Vol XI, No 5, p 765-772, May 1969. 2 fig, 2 tab, 5 ref.

Descriptors: *Slime, *Mass Transfer, *Diffusivity, Diffusion, Boundary processes, Dissolved oxygen, Microorganisms, Bacteria, Waste water treatment, Biological treatment.
Identifiers: Microbial slime films, *Microprobe, Steady state, Transient, Oxygen electrode, Gradient, Differentiation.

Microbial slime films are used in a variety of processes. They have been adapted directly from the natural environment for use in trickling filters. The critical factor controlling employment of these thin films is the mass transfer to and within them. In this instance, oxygen concentration near the surface and within a biological film was monitored using a microprobe oxygen electrode. With dilute medium, oxygen consumption was stable, indicating substrate limitation. With concentrated media, oxygen concentratior dropped indicating that oxygen supply was limited. Results indicated that substrate could be stored under conditions of high concentration, and then utilized later. This was not possible for oxygen because of its relatively low solubility. (Lowry-Texas)
W71-04484

THE ISOLATION OF VIRUSES FROM SEWAGE AND TREATED SEWAGE EFFLUENTS,
National Institute for Water Research, Pretoria (South Africa).
E. M. Nupen.
Water Pollution Control, Vol 69, No 4, p 430-455, 1970. 1 table, 31 ref.

Descriptors: *Vriuses, *Epidemiology, *Public health, Microbiology, Microorganisms, Diseases, Flocculation, Filtration, Chlorination, Water purification, E. Coli, Disinfection, Waste water treatment.
Identifiers: Roll tube assay method, Plaque Assay.

There are a great number of viruses in sewage and yet few virus epidemnics have been attributed to drinking water although current epidemiological methods may not be sensitive enough to detect viral transport via water. Some water purification processes reduce the number of eneric viruses in sewage and although physical and chemical procedures such as flocculation, sand filitration, and chlorination result in further removal or inactivation, no system so far developed entirely eliminates these viral particles. The current methods for viral quantification are limited and new techniques have been developed or are under investigation. Different viruses react in a different manner than E. Coli to most disinfection procedures so E. Coli cannot be used as a contamination indicator. (Ellis-Texas)
W71-04485

COLLECTION AND DISPOSAL OF FARM WASTES,
Ministry of Agriculture (Northern Ireland).
J. S. V. McAllister.
Water Pollution Control, Vol 69, No 4, p 425-429, 1970. 6 tab, 5 ref.

Descriptors: *Farm wastes, *Slurries, Sewage, Aeration, Incineration, Biochemical oxygen demand, Farm lagoons, Water pollution, Nitrogen, Ammonia, Methane, Hydrogen sulphide, Phosphorous, Waste water disposal, Waste water treatment.

Identifiers: *Pig slurries, *Poultry droppings, *Cattle excreta, Silage.

Improved farming techniques, suburban development, and a wider realization of the necessity to control pollution of the atmosphere and water supplies have increased the problem of farm waste collection and disposal. Generally, in Europe farm wastes are collected in the form of a slurry but disposing of this slurry is a problem. The use of this slurry as a manure has certain drawbacks and alternative methods of disposal such as drying, incineration, aeration treatment, or synthesis of feeding stuffs are explored. (Ellis-Texas)
W71-04486

NUTRIENT REMOVAL AND EFFLUENT POLISHING SYSTEMS,
Dravo Corp., Pittsburgh, Pa.
Gerald L. Lamb.
Water and Sewage Works, Vol 117, No 11, p 396-398, November 1970. 2 fig, 1 tab.

Descriptors: *Effluents, *Nitrates, *Phosphates, Biochemical oxygen demand, Coagulation, Aeration, Activated sludge, Filtration, Chlorination, Carbon, Digestion, Waste water treatment.
Identifiers: *Effluent polishing, *Phosphate removal, Nitrate removal, Nutrient removal.

A three part test program conducted by Dravo Corporation at Indian Lake Sewage Treatment Plant of the North Huntington Township Municipal Authority near Pittsburgh involved studies of effluent polishing, phosphate removal, and denitrification. The results obtained by their process is 98% removal of BOD5, 80% removal of phosphorous, but denitrification needs high temperatures if practical rates of nitrogen removal are to be obtained. (Ellis-Texas)
W71-04487

TANNERY PRE-TREATMENT PLANT DRASTICALLY CUTS BARRE'S TREATMENT PLANT LOAD.

Water and Pollution Control, April 1970, p 61-62. 1 fig.

Descriptors: *Waste water treatment, *Industrial wastes, Hydrogen ion concentration, Biochemical oxygen demand, Cost, Sedimentation, Sludge, Slime, Organic wastes.
Identifiers: *Tannery wastes, Suspended solids, Ether solubles, Barrie (Ontario, Canada).

Gore and Storrie Limited of Toronto, Canada was retained to design and supervise construction of a pre-treatment plant for tannery wastes. Prior to design sedimentation tests, sludge studies, the effect of polyelectrolytes, and water use reduction were scrutinized to determine how they affected treatment. The plant was designed and built by 1968 at a total cost of $195,000 and consisted of facilities to provide for screening, flow equilization, pre-aeration, settling, sludge removal and storage, scum removal, flow metering, tank truck removal of scum and sludge, and unwatering. This pretreatment significantly reduced the sludge volume in the city's treatment plant. (Ellis-Texas)
W71-04488

THE INFLUENCE OF TRIVALENT CHROMIUM ON THE BIOLOGICAL TREATMENT OF DOMESTIC SEWAGE,
British Leather Manufacturers' Research Association, Egham (England).
D. A. Bailey, J. J. Dorrell, and K. S. Robinson.
Water Pollution Control, Vol 69, No 1, p 100-110, 1970. 5 fig, 8 tab, 30 ref.

Descriptors: *Chromium, *Sewage treatment, *Anaerobic digestion, *Biological treatment, Filtration, Ammonia, Nitrogen, Nitrification, Sludge, Waste water treatment, Sludge diestion.

The literature contains many references on the effects of chromium on sewage treatment, but it mostly concerns hexavalent chromium. Experiments were conducted to determine the effect of trivalent chromium on anaerobic sludge digestion, biological filtration, and activated sludge. The data collected indicates that the acceptable levels of concentration of trivalent chromium in domestic sewage for effective biological treatment of such sewage are much higher than has been previously assumed. (Ellis-Texas)
W71-04489

SALMONELLA-ITS PRESENCE IN AND REMOVAL FROM A WASTE WATER SYSTEM,
Rijksinstituut voor de Volksgezondheid, Utrecht (Netherlands).
E. H. Kampelmacher, and L. M. van Noorle Jansen.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2069-2073, December 1970. 1 fig, 3 tab, 15 ref.

Descriptors: *Salmonella, *Cultures, Enteric bacteria, Microorganism, Pathogenic bacteria, Waste water treatment, Sewage treatment, Trickling filters, Sedimentation, Retention, Gamma rays, Tracers.
Identifiers: *Salmonellosis, Gamma scintillation counter, Radioactive nuclide, Most probable number (MPN).

A study was made to determine the degree of contamination by Salmonella of waste water by qualitative and quantitative methods in a waste treatment plant in a Dutch town of over 100,000 people. An attempt was also made to establish whether salmonella is eliminated by the trickling filter process. When 3 x 10 in S. utrecht germs were added to the influent, an average of 60 germs/100 ml effluent were recovered in 10.5 hours while normal operation shows 100 germs/100 ml of Salmonella germs. It can be maintained that 10 upper 10 salmonella germs enter the plant each hour while 10 upper 9 salmonella germs are released with the effluent each hour. The reduction in the concentration of salmonella is quite small and disinfection of the effluent merits consideration. (Ellis-Texas)
W71-04492

TREATMENT OF WINE DISTILLING WASTES BY ANAEROBIC DIGESTION,
Council for Scientific and Industrial Research, Pretoria (South Africa).
G. J. Stander.
Proceedings 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol L II, no 3, p 892-907, July 1968. 8 fig, 4 tab, 6 ref.

Descriptors: *Anaerobic digestion, Domestic wastes, Sewage treatment, Waste water treatment, Stabilization, Biochemical oxygen demand, Chemical oxygen demand, Phosphates, Nitrogen, Costs.
Identifiers: *Wine distillery wastes, Spent wine, Ethyl alcohol, South Africa, Dorr-Oliver Clarigester.

A program of operational research with a full-scale treatment plant located in the main wine producing area of South Africa has been undertaken by the Cape Regional Laboratory of the National Institute for Water Research (NIWR). Laboratory and pilot scale studies have been conducted from 1948 to date and have indicated that anaerobic digestion might provide a practical method for dealing with wine wastes. The full-scale treatment plant consists of a modified 'Dorr-Oliver Clarigester' and the description and operation of this plant is discussed. Many unknown factors which existed in regard to the biological, metabolic pathways, technological, and physical aspects of the practical operation of an anaerobic digestor are included. The effluent from the anaerobic digestion of spent wine still contains approximately 1.8% of its original COD which amounts to about 400 mg/l and this needs additional stabilization which can be accomplished in conventional sewage treatment. The cost type of treatment is approximately 56 ce 1000 gallons. (Ellis-Texas)
W71-04493

COMBINED WASTE TREATMENT AT G ISLAND, NEBRASKA,
Black and Veatch, Kansas City, Mo.
W. R. Gibbs, and H. Benjes, Jr.
Proceedings, 22nd Industrial Waste Conf May 2, 3, 4, 1967, Purdue University, Vol 3, p 800-812, July 1968. 6 fig, 5 tab.

Descriptors: *Municipal wastes, *Industrial *Activated sludge, Capital costs, Operating Biochemical oxygen demand, Aeration, Se tation, Ventura flumes, Nebraska, Waste treatment.
Identifiers: Meat packing wastes, Milk proc Steam-electric generation, Suspended Parshall Flume, Grit chamber, *Combined treatment.

Studies were undertaken to determine the na the industrial wastes, of determining whet domestic and industrial wastes could be more economically and efficiently in combi separate facilities, and which processes offe greatest advantages. These exhaustive stud to the conclusion that maximum efficien economy would be realized by combined tre of domestic and industrial wastes in a new ment plant incorporating the complete mix tivated sludge process, and abandonment of isting treatment facilities. A discussion planning, design, operation, problems, and c included. Studies are continuing of oper controls and process modifications which ticipated to increase the treatment efficien reduce operating costs. (Ellis-Texas)
W71-04494

MICRO-STRAINING AND OZONIZATIO WATER AND WASTE WATER,
Glenfield and Kennedy Ltd., London (Englar
P. L. Boucher.
Proceedings, 22nd Industrial Waste Confe May 2, 3, 4, 1967, Purdue University, Vol 3, p 771-787, July 1968. 6 tab, 13 ref.

Descriptors: *Ozone, Water purification, reuse, *Chlorination, *Coagulation, Filtratio ters, Waste water treatment, Sewage trea Particle size, Electrophoresis, Microbi Microorganisms.
Identifiers: *Microstraining, Micellation/De lation, Rapid-sand filtration.

A brief review of Micro-Straining, Ozoni and Micellation/Demicellation is conc preliminary to giving an account of the inv tion done at the Eastern Sewage Works of th don Borrough of Redbridge. A series of tes run to determine the effect of the microzo Micellation/Demicellation processes on the cal, chemical, and microbiological condition typical sewage effluent. SS concentr decreased progressively but the largest red was effected by the micro-strainer. Most nitrite was oxidized by ozone but TDS, N, compounds were virtually unaffected. Colo turbidity removal was effective but organic removal was not particularly effective. straining made virtually no difference to the of any microbiological groups but while killed a majority of the organisms it di produce a sterile effluent. Electrophoresis an ticle size distributions were also studied as w the cost of operating this treatment process. Texas)
W71-04495

BIODEGRADATION OF LAS BENZENE R IN ACTIVATED SLUDGE,
Monsanto Co., St. Louis, Mo.
R. D. Swisher.

eedings, 22nd Industrial Waste Conference, 2, 3, 4, 1967, Purdue University, Vol LII, No 375-392, July 1968. 7 fig, 3 tab, 18 ref.

riptors: *Biodegradation, *Activated sludge, age treatment, Biological treatment, Water ication, Surfactants, Detergents, Sulfonates, ar alkyl sulfonates, Colorimetry, Spec- otometry, Waste water treatment.
ifiers: *LAS Benzene rings, Warburg rometry.

st complete removal of the benzene rings of can be accomplished by activated sludge a variety of conditions. An experiment was cted to study the ring degradation of 3-phen- 6-phenyldodecane. A small residual UV ad- on corresponding to a few percent of the ini- ngs were encountered and may have been d by: (1) insufficient time for complete dation; (2) the possibility that the residual ial originates in small amounts of impurities t in the samples; (3) and the possibility that odegradation pathways are involved, a major ading to complete destruction, and a minor rminating in a dead end somewhere short of ete degradation. However, this effect is of consequence, since ring degradation eds to the extent of 85-90% or more with isomer. Continuous and semi-continuous ent tests were conducted and led to the con- that a 24 hour semi-continuous feed is not a vigorous biodegradation system than a con- s flow with a shorter residence time. In- tions have shown that effluents from the radation of LAS are non-toxic at LAS levels mg/l or more which is much higher than n the field. (Ellis-Texas)
4496

ESS CONTROL FOR ACTIVATED GE,
l American Transportation Corp., Niles, Ill.
ander, and Bernard Johnson.
dings, 22nd Industrial Waste Conference, 3, 4, 1967, Purdue University, Vol LII, No 3-413, July 1968. 6 fig, 1 tab.

tors: *Activated sludge, *Mathematical , Aeration, Effluents, Dissolved oxygen, mical oxygen demand, Waste water treat- Vater pollution control.
ers: *Return sludge flow, Return sludge tration, Recirculation.

American was asked to study the feasibili- tomating an activated sludge plant. To do ameters requiring measurement had to be d and interrelationships between the vari- ameters had to be discovered in order to af- ntinuous control. Once mathematical were set up it became apparent that sludge had an important effect on the quantities equired measurement and control. Con- y, three types of recirculation schemes nsidered: (1) constant BOD reduction) constant BOD in effluent, (3) and con- ight of returned sludge. These processes a certain measure of self regulation which hem to cope with changes in the influent environment but each process has one measurement requirement in the return lis-Texas)
497

ARGEST OXIDATION DITCH IN THE FOR THE TREATMENT OF INDUS- VASTES,
dse Staatsmijnen N. V., Geleen.
a.
ngs, 22nd Industrial Waste Conference, , 4, 1967, Purdue University, Vol LII, No 730, July 1968. 15 fig, 4 tab.

rs: *Oxidation, *Activated sludge, tion, Industrial wastes, Biochemical ox- and, Chemical oxygen demand, Nitrogen, Nitrification, Ammonia, Denitrification, Phosphorous, Hydrogen ion concentration, Cost analysis, Waste water treatment, Biological treatment.
Identifiers: *Oxidation ditch, Pasveer ditch, Netherlands.

An investigation was made of the biological treatment of waste water coming from two coking plants, a plant whose effluent contained chemicals used in the preparation of polyethylene and formaldehyde, and a third type of plant which discharged large amounts of organic wastes. A comparison of the activated sludge process versus the oxidation was made and the latter process was deemed to be more appropriate for treatment of this particular waste. The biological purification under nitrification and denitrification conditions, the trouble caused by a shortage of phosphorous, maximum capacity of the ditch and plans to enlarge the capacity, capital and operating costs, and other data on the Pasveer Ditch are discussed. (Ellis-Texas)
W71-04498

NITRO-CELLULOSE INDUSTRIAL WASTE,
Technische Hochschule, Hanover (West Germany). Inst. of Sanitary Engineering.
Klaus Mudrack.
Proceedings, 21st Industrial Waste Conference, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 656-664. 7 fig, 12 ref.

Descriptors: *Cellulose, *Acidity, *Alkalinity, *Neutralization, Corrosion, Denitrification, Hardness (Water), Sulfates, Microorganism, Metabolism, Centrifugation, Purification, Activated sludge, *Chemical wastes, Waste water treatment, Industrial wastes, Sulfur.
Identifiers: Nitro-cellulose, Gun-cotton, Collodion, Nitric acid, Sulfuric acid.

Nitro-cellulose wastes contain nitric acid, sulfuric acid and various other chemicals, including an extremely high content of sulfur. Neutralization is imperative whether the waste is treated biologically or discharged to a dilutant stream. Further addition of phosphorous in the amount of .2 mg/l is necessary to support biological treatment. The high nitrate content of nitro-cellulose waste allows it to be treated in a biological denitrifying process rather than conventional activated sludge. The advantages of the denitrification process are: (1) treatment is achieved with no artifical oxygen supply; (2) the nitrate content of the sewage is reduced; (3) the pH value of the sewage increases during treatment; (4) less excess sludge is produced. Close control must be maintained over the process since the high nitrate content gives the sludge a tendency to float. Care must also be taken in the design of the plant, since even the neutralized waste streams are sufficiently high in sulfates to cause corrosion difficulties, particularly in concrete pipes. (Lowry-Texas)
W71-04499

TREATMENT OF PHOTOGRAPHIC LABORATORY WASTES AT NORTON AIR FORCE BASE, CALIFORNIA,
Montgomery Research, Inc., Pasadena, Calif.
Paul V. Hennessy, Donald G. Rosenberg, and Raymond G. Zehnpfenning.
Proceedings, 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 740-751, July 1968. 1 fig, 7 tab.

Descriptors: *Industrial wastes, *Groundwater, Activated sludge, Trickling filters, Sewage treatment, Geology, Conductivity, Hydrogen ion concentration, California, Waste water treatment, Biological treatment.
Identifiers: *Cyanide, *Ferrocyanide, *Ferricyanide, Norton Air Force Base (Calif), San Bernardino (Calif), *Photographic wastes.

Norton Air Force Base disposes of sanitary and industrial wastes through the facilities of the City of San Bernardino which uses secondary biological processes in the treatment of its wastes. The geological setting of this area is such that the waste water that leaves this area is used again by municipalities and agriculture, therefore, it is essential that minerals and toxic materials must be adequately treated or disposed of to prevent a buildup of these elements. Methods of disposal, regulation of discharge, the monitoring program, the nature of the waste streams, and the treatment of cyanide are discussed in relation to Norton Air Force Base. (Ellis-Texas)
W71-04500

FLYASH AS A FILTERING AID FOR DEWATERING INDUSTRIAL WASTE SLUDGE,
Uniroyal, Inc., Mishawaka, Ind.
F. W. Moehle.
Proceedings, 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 429-440, July 1968. 7 fig.

Descriptors: *Dewatering, *Fly ash, *Filtration, *Sludge, *Industrial wastes, Sludge treatment, Sludge disposal, Hydrogen ion concentration, Chutes, Conveyance, Structures, Temperature, Waste water treatment, Indiana.
Identifiers: Sludge concentration, Vacuum filter, Filter drums, Compressed air.

Dewatering industrial waste plant sludge using flyash has proven successful at Uniroyal, Inc., U. S. Rubber plant located at Mishawaka, Indiana. In the process of dewatering the sludge, six major pieces of equipment are involved: (1) a filter drum that works on vacuum filtration; (2) a screw type conveyor to mix the sludge-flyash mixture and transport it to the filter drum; (3) a centrifuged blower is used to maintain the desired vacuum in the filter drum vacuum chambers; (4) filtrate pump; (5) a blower type air compressor that supplies air to the vacuum filter for filter cake removal; and (6) a cake collecting chute and conveyor. Field and lab studies considered: (1) the proper concentrations of flyash; (2) the effect of sludge temperature on the dewatering process; (3) the effect of pH of the sludge; (4) the effect of sludge solids concentration; and (5) the effect of various vacuum conditions for proper sludge dewatering. (Ellis-Texas)
W71-04502

HYDRAULIC AND PROCESS ASPECTS OF REACTOR DESIGN-I, BASIC CONCEPTS IN STEADY-STATE ANALYSIS,
Rice Univ., Houston, Tex.
J. C. McLellan, and A. W. Busch.
Proceedings, 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 537-552, July 1968. 8 fig, 3 tab, 15 ref.

Descriptors: *Hydraulics, *Activated sludge, *Design, Biochemical oxygen demand, Organic wastes, Retention, Aeration, Waste water treatment.
Identifiers: *Steady-state analysis, Substrate utilization, Mixed liquor, Suspended solids.

A method by which the poundage of microorganisms required to remove a total poundage of soluble organic waste in a given period of time and produce an effluent of a given substrate concentration is presented. The interaction of the flow rate and influent substrate concentration affects effluent quality in the activated sludge process. The effects of either of these factors may be negated by control of the MLSS poundage in the aerator up to the limiting MLSS concentration. One of the critical points in choosing an aerator volume is the ability to control the MLSS concentration. Once the reactor volume has been chosen, the MLSS concentration governs effluent quality. Hydraulic retention time is not a fundamental criterion of activated sludge process design because the apparent need for increased hydraulic detention time may be offset by increases in MLSS poundage. Subsequent papers in this series will extend the analysis to unsteady-state conditions. (Ellis-Texas)
W71-04503

LIMITATIONS OF OXYGEN TRANSFER IN THE WARBURG APPARATUS,
Rice Univ., Houston, Tex.
J. O. Bryant, W. W. Akers, and A. W. Busch.
Proceedings, 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 686-698, July 1968. 6 fig, 2 tab, 29 ref.

Descriptors: *Mass transfer, *Respiration, *Oxygen, Pressure, Biochemistry, Waste water treatment, Degradation, Oxidation, Oxygen demand.
Identifiers: *Warburg apparatus, *Oxygen transfer, Glutamic acid, Glucose, Oxygen uptake.

In order to show that oxygen transfer rates can limit the rate of biological reactions in the Warburg system, experiments were conducted to determine oxygen uptake progressions for the degradation of glutamic acid, glucose, sodium acetate, and pyruvic acid by mixed microbial populations at oxygen partial pressures of 0.21, 0.50, and 1.0 atmospheres in the Warburg respirometer. The limiting mechanism in oxygen uptake progressions obtained under these experimental conditions for plateau oxygen demands greater than 100 mg/l is the physical transfer of oxygen from the gas to the liquid phase. Oxygen limitation in the system may affect the study of biological oxidation by distorting apparent reaction stoichiometry and by yielding erroneous rate measurements. (Ellis-Texas)
W71-04504

CANNERY WASTE TREATMENT PART II. TREATABILITY,
San Jose State Coll., Calif.
F. J. Agardy, R. G. Spicher, and G. T. Orlob.
Proceedings, 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 699-705, July 1968. 1 fig, 2 tab.

Descriptors: *Waste treatment, *Canneries, Organic matter, *Biodegradation, *Organic wastes, Biochemical oxygen demand, Chemical oxygen demand, Toxicity, Waste water treatment.
Identifiers: Peach waste, Tomato waste, Carbonaceous, Biodegradation rate.

An analysis of dissolved versus suspended solids, volatile and inert SS, volatile and inert DS, volatile and inert TS, the disposition of BOD and COD, and biodegradation rate studies were conducted. The cannery waste of tomatoes and peaches were found to have a high percentage of organic matter in solution. This distribution of organic matter favors the employment of biochemical treatment methods suitable for stabilization of dissolved organics as opposed to physical processes. There is a possibility that high concentrations of cannery wastes might result in a reduction of biodegradation rate due to a lack of required nutrients or presence of trace inhibitory agents. (Ellis-Texas)
W71-04505

AQUA AMMONIA NEUTRALIZATION OF ACID EFFLUENT FROM A DEIONIZER,
Carling Breweries Ltd., Waterloo (Ontario).
W. R. Garvie, and D. E. Waite.
Proceedings, 21st Industrial Waste Conference, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 650-655. 3 fig, 1 tab.

Descriptors: *Hydrogen ion concentration, *Neutralization, *Alkalinity, *Acidity, Nitrogen compounds, Mixing, Solubility, Ion exchange, Biocehmical oxygen demand, Automatic control, Chemical wastes, Waste water treatment, Ammonia compounds, Effluents.
Identifiers: *Caustic soda, *Aqua ammonia, Regeneration, Resin exhaustion, Deionizer.

Overall benefits of aqua ammonia are: (1) Reduced chemical costs based on equivalent weights; (2) Reduced chemical costs based on more efficient neutralization; (3) Improved automatic control yielding a more uniform effluent to the sewers; (4) Reduced suspended solids in the effluent as a result of increased solubility of ammonia salts; (5) Provision of a prime source of available nitrogen to the activated sludge process of the sewage treatment plant. Problems associated with the use of ammonia nitrogen are primarily associated with fumes, corrosive effects, and danger of explosion. Proper ventilation, inspection, and maintenance are imperative. If properly designed and maintained, ammonia nitrogen neutralizing equipment can successfully alleviate most acid waste problems with good economic competitiveness. (Lowry-Texas)
W71-04506

DECONTAMINATION OF CYANIDE WASTES BY METHODS OF CATALYTIC OXIDATION AND ADSORPTION,
Ruhr River Association, Essen (West Germany).
Wilhelm Bucksteeg.
Proceedings, 21st Industrial Waste Conference, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 688-695. 1 fig, 5 tab, 3 ref.

Descriptors: *Chemical wastes, *Adsorption, *Oxidation, *Catalyst, Sedimentation, Trickling filters, Biodegradation, Biological treatment, Waste water treatment.
Identifiers: *Cyanide wastes, *Low temperature coke, *Sewage sludge charcoal, Galvanic wastes, Toxic shock, Ceramic.

Low temperature coke made from soft brown coal shows surprising ability to adsorb and oxidize potassium cyanide and free cyanide. The cyanide is adsorbed onto the surfaces of the coke grains and part of it is oxidized to CO2, nitrogen, and water, while the rest is decomposed to carbon dioxide and ammonia. Experiments with low temperature coke and sewage sludge charcoal showed removals of cyanide in the 90 to 99% range. Filters made with low temperature coke have two distinct advantages to users. Manufacturers can often recycle water from which cyanides have been removed. This means considerable savings to manufacturing concerns. Also, waste water filtered to remove cyanides can then be treated biologically, and by incorporating an upper layer of coke and ceramic material with a conventional filler in a lower layer, then cyanide removal and biological treatment can be achieved in the same facility at great savings. (Lowry-Texas)
W71-04507

THE TREATMENT OF FLUORIDE WASTES,
Corning Glass Works, N.Y.
W. Zabban, and H. W. Jewett.
Proceedings, 22nd Industrial Waste Conference, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 706-716, July 1968. 8 fig, 7 ref.

Descriptors: *Waste water treatment, Sedimentation, Chemical precipitation, *Neutralization, Toxicity, Industrial wastes, Hydrogen ion concentration, Temperature, Ion exchange.
Identifiers: *Fluoride wastes, *Activated alumina, Sodium hydroxide, Bone char, Hydrofluoric acid waste, Calcium hydroxide.

Hydrofluoric acid wastes mixed with abrasive and siliceous wastes have been treated satisfactorily at a number of plants by neutralization with calcium hydroxide and sedimentation in continuous clarification units at pH values of slightly over 11. Clarified effluents containing less than 20 mg/l of fluoride ion are produced. If the treated effluent is allowed to stand for several hours, post precipitation of fluoride salt will occur, thus increasing the concentration of fluoride in the effluent to within the solubility limits for calcium fluoride. Where required, additional fluoride removal may be obtained by passage of the fluoride waste through a bed of activated alumina regenerated with sulfuric acid, or through bone char regenerated with sodium hydroxide. (Ellis-Texas)
W71-04508

INDUSTRIAL REUSE OF MUNICIPAL WASTE WATER,
Fuller Co., Tucson, Ariz.
C. F. Garland, and L. K. Cecil.
7th Industrial Water and Waste Conferenc
Water Pollution Control Association, June
p IV-1-IV-10, 1967. 3 tab, 10 ref.

Descriptors: *Municipal wastes, *Industrial
Sludge disposal, Domestic wastes, A
sludge, Ion exchange, Chemical reaction,
adsorption, Filter, Lime, Activated carbon
water treatment, *Water reuse, *Tertiar
ment.
Identifiers: INFILCO, Recarbonator, Soli
tact stabilizer.

INFILCO initiated two pilot plant studies fo
ry treatment of the effluent from a 12 M
tivated sludge plant. One system is ba
complete treatment of all water before wit
for reuse and includes the following: (1) a c
treatment unit; (2) a sand filter; (3) a prin
tion exchanger; (4) carbon adsorption c
(5) a primary anion exchanger; (6) a secon
tion exchanger; and (7) a secondary
exchanger. The other system involves a s
treatment operations which progressively
water quality, and from which water may b
for specified uses as soon as individual use
ments are met. Units involved in this pro
clude: (1) a lime treatment unit; (2) a rec
tor; (3) a solids-contact stabilizer; (4) a san
and (5) a carbon contactor. The cost of
process is around 40 cents/1000 gallons w
second system would cost around 42.5 cen
gal. (Ellis-Texas)
W71-04509

**THE TAHOE PROCESS FOR NUT
REMOVAL,**
Cornell, Howland, Hayes, and Merryfield,
lis, Oreg.
Russell L. Culp.
7th Industrial Water and Waste Conferenc
Water Pollution Control Association, p I-3
June 1 and 2, 1967. 12 fig, 2 tab, 34 ref.

Descriptors: *Activated carbon, *Adsorptio
tration, *Lime, Sewage treatment, Tertiar
ment, Water purification, Phosphate, N
Coagulation, Activated sludge, California
water treatment.
Identifiers: *Lake Tahoe, Recarbo
Regeneration, Lime recalcining, A
stripping, *Nutrient removal.

A 2 1/2 MGD water reclamation plant wa
into operation during the summer of 1965
Tahoe, California. The process which evolv
the operating experience of this original
plant plus the information gained from this
stration was the basis for the design of an ex
process capable of handling 7 1/2 MGD. T
process not only removes phosphates, n
and organics present in waste waters, but a
vides for the recovery and reuse of chemic
ployed in the process. All solid wastes are
to sterile ash by incineration. The total inv
to provide tertiary treatment will be almost
that for providing secondary treatment at
(Ellis-Texas)
W71-04510

**PRACTICAL AND TECHNICAL ASPEC
REUSING EFFLUENT FROM WASTE T
MENT PLANTS,**
Eimco Corp., Salt Lake City, Utah.
A. A. Kalinske.
7th Industrial Water and Waste Conferenc
Water Pollution Control Association, June
1967, p IV-35-IV-44. 11 ref.

Descriptors: *Water reuse, *Advanced was
ment, *Tertiary treatment, Recharge, Pho
Nitrates, Biochemical oxygen demand, An
Chemical oxygen demand, Hardness, Det
Waste water treatment.
Identifiers: *Suspended solids.

ıse of waste water for domestic and industrial
s is technically and economically feasible and
ified today. A progressive approach to waste
ıtment is discussed in view of possibly eliminat-
some of our older methods of treatment if
essary. Removals of suspended solids,
sphates, and nitrogen from waste waters are
ussed in light of a recent practical problem in-
ing a pilot plant study of treating a trickling
r plant effluent for use as cooling and makeup
er in a stream power plant. (Ellis-Texas)
1-04511

EVALUATION OF DIFFUSION MEM-
ANES FOR WASTE WATER REHABILITA-
N,
r-Oliver, Inc., Stamford, Conn.
. Okey, and R. A. Fiedler.
Industrial Water and Waste Conference, Texas
er Pollution Control Association, June 1 and 2,
, p IV-16-IV-34. 10 fig, 2 tab, 8 ref.

criptors: *Diffusion, *Membranes, *Filtration,
vated sludge, Waste water treatment,
sphorous, Desalination, Biochemical oxygen
and, Activated sludge, Sludge treatment,
s.
tifiers: Suspended solids.

nalysis of the pertinent system theory, a series
xperiments on a membrane system, and an
omic analysis have been carried out. This ex-
nental work indicated the use of a diffusion
brane system as an activated sludge phase
ration device, a system study of the flux,
city solids, and pressure interrelationship, and
alysis of the movement of phosphorus through
mbrane augmented activated sludge facility.
study of system economics included inputs
the literature as well as the results of the work
ted here. (Ellis-Texas)
-04512

SPHATE REMOVAL BY ACTIVATED
GE, PART I: PILOT-SCALE EX-
ENCE,
ral Water Pollution Control Administration,
Okla.
Priesing.
ndustrial Water and Waste Conference, Texas
r Pollution Control Association, June 1 and 2,
p II-4 to II-5.

riptors: *Phosphates, *Activated sludge,
emical oxygen demand, Dissolved oxygen,
r pollution, Filtration, Texas, Oklahoma,
e water treatment, Sludge treatment, Aera-

fiers: *Phosphate removal.

ion jug studies were utilized to pilot research
nge and limitations associated with applica-
f the operational parameters considered sig-
nt to phosphate removal. Five municipal
treatment plants at diverse locations were
ed and tested for amenability to phosphate
al. These tests showed that diverse wastes
udges can be adapted to phosphate removal
ntrol of operational parameters in the ac-
d sludge process. (Ellis-Texas)
04513

PHATE REMOVAL BY ACTIVATED
GE, PART II: PLANT EXPERIENCE,
al Water Pollution Control Administration,
Okla.
Vitherow.
dustrial Water and Waste Conference, Texas
Pollution Control Association, June 1 and 2,
p II-6-II-7.

ptors: *Phosphates, *Activated sludge,
emical oxygen demand, Filtration, Tracers,
Waste water treatment, Sludge treatment,
on.
iers: San Antonio (Tex), Iron-59,
phate removal.

A 24 hour profile of the Rilling Plant in San Antonio, Texas, established that phosphate removal followed a daily cycle. Aeration detention time and minimum solids detention time in the final clarifiers are important parameters in phosphate removal and depend on the hydraulic characteristics of the aeration basins and the final clarifiers. (Ellis-Texas)
W71-04514

UPTAKE OF SOLUBLE PHOSPHATE BY ACTIVATED SLUDGE: PARAMETERS OF INFLUENCE,
Maine Univ., Orono.
Millard W. Hall, and Richard Engelbrecht.
7th Industrial Water and Waste Conference, Texas Water Pollution Control Association, June 1 and 2, 1967, p II-8-II-27. 7 fig, 4 tab, 14 ref. United States Public Health Service Research Fellowship No 5-F1-WP21,616-03.

Descriptors: *Phosphate, *Activated sludge, *Dissolved oxygen, *Aeration, Hydrogen ion concentration, Chemical oxygen demand, Waste water treatment.
Identifiers: *Mixed liquor, Suspended solids, *Substrate.

An assessment by laboratory experimentation of the influence of mixed liquor suspended solids concentration, substrate concentrations and dissolved oxygen concentration on the magnitude and rate of soluble phosphate reduction in activated sludge mixed liquor. Aeration on time was found to be an important parameter inasmuch as 90% reduction of the phosphate content was achieved in a 24 hour period but 50% of this was achieved in the first 6 hours. The MLSS concentration in the range employed by most activated sludge plants was not a significant factor in phosphate removal. Soluble phosphate uptake increased with increasing initial soluble substrate concentration. Soluble phosphate reduction is also dependent upon the DO concentration. (Ellis-Texas)
W71-04515

ON PURIFICATION OF RADIOACTIVE WASTE WATER BY CONTACT PRECIPITATION. 4TH COMMUNICATION: EFFECT OF COMPLEX FORMERS, DETERGENTS, AND WASH LIQUIDS, (IN GERMAN),
Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (East Germany).
G. Sachse, and H. Schlenkrich.
Kernenergie, Vol 12, No 11, p 363-367, 1969. 3 fig, 5 tab, 8 ref.

Descriptors: *Waste water treatments, *Radioactive wastes, Detergents, Precipitable water, Separation techniques, Waste disposal, Nuclear powerplants, Calcium carbonate, Water purification.
Identifiers: Cerium-141, Strontium-90, Condensed phosphates, Dresden (Germany).

This part of the investigations of waste water was concerned with the effect of complex formers and detergents on contact precipitation and behavior of cerium-141 and strontium-90. It was demonstrated that oxalic, citric, and tartaric acids in concentrations between 100 and 150 mg/l, as well as the detergents and wash liquids up to concentrations from 75 to 100 mg/l, exert no detrimental influence on calcium carbonate precipitation. On the other hand, strong complex formers, such as condensed phosphates and EDTA, invariably and totally prevent contact precipitation and separation of radionuclides. The contact precipitation increased slightly the separation of Ce-141 and Sr-89. Contact precipitation should be used in purification of radioactive waste water of atomic energy plants. (Wilde-Wisconsin)
W71-04521

TERTIARY TREATMENT OF COMBINED WASTE WATER,
Calgon Corp., Pittsburgh, Pa. Filtrasorb Dept.; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
R. H. Zanitsch, and J. M. Morand.
Water and Wastes Engineering, Vol 7, No 9, p 58-60, 1970. 4 fig, 1 tab, 3 ref.

Descriptors: *Carbon, *Tertiary treatment, Industrial wastes, Domestic wastes, Activated carbon, Ohio, Adsorption, Organic matter, Suspended load, Biochemical oxygen demand, Color, Isotherms, Effluents, Microorganisms, Trickling filters, Spectrophotometry, Waste water treatment, California.
Identifiers: *Combined waste water, Cincinnati (Ohio), Pomona (Calif), Lake Tahoe (Calif), Organic dyes, Fluorescein.

The feasibility of removing refractory organic material and dyes from an activated sludge effluent using granular activated carbon was studied. A colorless effluent containing an average of 3 mg/l biochemical oxygen demand and 3 mg/l suspended solids was produced in the 61-day trial. Tertiary treatment with granular activated carbon has been demonstrated in a pilot scale at Pomona, California; a full-scale advanced waste treatment plant is in operation at Lake Tahoe, California. The source of waste water for each of these plants is basically of domestic origin, free of industrial contamination. At the Mill Creek Sewage Treatment Plant in Cincinnati, the influent is a combined industrial-domestic waste containing organic dyes, one of which is fluorescein. The green fluorescein color is soluble and, therefore, is not removed by primary treatment. In a preliminary test, an adsorption isotherm study was conducted on a grab sample; the isotherms demonstrated that the soluble organic carbon level of secondary effluent could be significantly reduced by adsorption on activated carbon. The carbon columns were used as both a filter and an adsorber. The fluorescein dye color bodies were effectively removed by adsorption on the granular carbon. (Jones-Wisconsin)
W71-04533

BIOCHEMICAL OXIDATION OF HYDROCARBONS IN NATURAL WATERS,
Rhode Island Univ., Kingston. Dept. of Bacteriology.
Chester W. Houston.
Available from NTIS as PB-197 585, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Rhode Island Water Resources Center, (1971). 34 p, 4 tab, 15 fig, 10 ref. OWRR Project B-020-RI (1).

Descriptors: *Hydrocarbons, Kinetics, Cultures, *Oxidation, Temperature, Cytological studies, Productivity, *Fermentation.
Identifiers: *Heptane, Continuous culture, Microbial oxidation, *Cell growth rates.

A study of the kinetics of microbial oxidation of hydrocarbons was carried out using a one organism-pure hydrocarbon system (Pseudomonas aeruginosa-heptane). In batch culture, heptane supply is growth limiting at a cell concentration of 3 g/l on a dry basis. The cell concentration was increased to 8 g/l when heptane was volatilized in the influent air to increase interfacial area and mass transfer. Specific growth rate is increased by temperature more than can be accounted for by the effect of temperature alone on growth rate. The effect is attributed to the higher solubility of heptane at the higher temperature. Wash-out characteristic of continuous cultures on heptane differ from the theoretical and is explained on the basis of mass transfer limitations. Steady-states are possible at dilution rates higher than those predicted from batch cultures. Productivity was found to be 1.5 g/l/hr at D—0.26 with a heptane feed rate of 18 ml/hr. Limitation of magnesium or iron in the heptane limited cultures resulted in a marked increase in heptanoic acid production; heptane growth cells had a markedly higher lipid content than those grown on glucose.
W71-04543

FEASIBILITY STUDY MANUAL - MINE WATER POLLUTION CONTROL DEMONSTRATIONS.
NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

For primary bibliographic entry see Field 05G.
W71-04545

COLLECTED PAPERS REGARDING NITRATES IN AGRICULTURAL WASTE WATERS.
Federal Water Quality Administration, San Francisco, Calif.
For primary bibliographic entry see Field 05B.
W71-04546

DESALINATION OF IRRIGATION RETURN WATERS,
Federal Water Quality Administration, Fresno, Calif. San Joaquin Project.
Bryan R. Sword.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030 ELY, 12/69, p 81-105, December 1969. 25 p, 14 fig, 7 tab, 1 ref. FWQA Project 13030 ELY.

Descriptors: *Water pollution control, *Desalination, *Drainage water, Electrodialysis, California, Drainage effects, Reverse osmosis, Water pollution sources, Drainage programs.
Identifiers: *Central Valley (Calif), *Groundwater pollution control.

Experiments were conducted from June 1967 to November 1968, on the desalination of agricultural tile drainage waters near Firebaugh, California. The water used in these studies was collected by a system of tile drains servicing a 400-acre field. These waters, which have percolated through 5 to 9 feet of soil, contained a total dissolved solids (TDS) concentration of from 2,500 to 8,000 mg/liter. Desalination of San Joaquin Valley tile drainage water was found to be technically feasible. The initial reverse osmosis stack was able to achieve over 90% TDS removal; however, nitrate and boron removals averaged less than 27%. The electrodialysis unit had an average TDS removal of 23%. The cost of supplies and power for reverse osmosis (Stack II) was $0.41 per thousand gallons of product. The same costs for electrodialysis came to $0.15 per thousand gallons of product. (See also W71-04546) (Knapp-USGS)
W71-04552

BACTERIAL DENITRIFICATION OF AGRICULTURAL TILE DRAINAGE,
Federal Water Quality Administration, Fresno, Calif. San Joaquin Project; and Stanford Univ., Calif. Dept. of Environmental Engineering.
Thomas A. Tamblyn, Perry L. McCarty, and Percy P. St. Amant.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030 ELY, 12/69, p 107-121, December 1969. 15 p, 3 fig, 2 tab, 19 ref. FWQA Project 13030 ELY.

Descriptors: *Waste water treatment, *Water pollution control, *Denitrification, *Biodegradation, *Drainage water, California, Drainage programs, Anaerobic bacteria, Anaerobic conditions, Lagoons.
Identifiers: *Central Valley (California), *Bacterial denitrification.

Initial field studies in the Central Valley of California of bacterial denitrification of irrigation waste water in simulated deep ponds indicated that significant denitrification could take place in ponds with detention times as low as 5 days. Covered ponds consistently outperform the uncovered one. Large algal populations develop in uncovered ponds and the resultant high dissolved oxygen concentration inhibits denitrification. More influent is short-circuited through the uncovered pond because of wind mixing and temperature variations. Treatment in either anaerobic ponds or filters will most likely cost between $30 and $60 per million gallons of waste treated. Agricultural tile drainage can be biologically treated and discharged to the San Francisco Bay System at less cost than that of any alternative plan. (See also W71-04546) (Knapp-USGS)
W71-04553

ALGAL NUTRIENT RESPONSES IN AGRICULTURAL WASTE WATER,
Federal Water Quality Administration, Fresno, Calif.; and California State Dept. of Water Resources, Fresno.
James F. Arthur, Randall L. Brown, Bruce A. Butterfield, and Joel C. Goldman.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030 ELY, 12/69, p 123-141, December 1969. 19 p, 8 fig, 1 tab, 12 ref. FWQA Project 13030 ELY.

Descriptors: *Algae, *Waste water treatment, *Water pollution control, *Denitrification, *Biodegradation, *Drainage water, California, Drainage programs, Anaerobic bacteria, Anerobic conditions, Lagoons.
Identifiers: *Central Valley (California), *Bacterial denitrification.

Algal assimilation of nutrients into cellular material with subsequent removal from the growth medium is a feasible process to remove nitrates from irrigation waste water. The efficiency of the proposed system is greatly enhanced if as many variables as possible are optimized, leaving only nitrogen the limiting nutrient. Orthophosphate additions of 2.0-3.0 mg/liter P are required the year round to remove 20.0 mg/liter nitrate-nitrogen from the growth medium. Iron and carbon also have been found to be limiting algal growth and nitrogen assimilation during part of the year. (See also W71-04546) (Knapp-USGS)
W71-04554

THE EFFECTS OF NITROGEN REMOVAL ON THE ALGAL GROWTH POTENTIAL OF SAN JOAQUIN VALLEY AGRICULTURAL TILE DRAINAGE EFFLUENTS,
California State Dept. of Water Resources, Fresno; and Federal Water Quality Administration, Alameda, Calif.
Randall L. Brown, Richard C. Bain, Jr., and Milton G. Tunzi.
In: Collected Papers Regarding Nitrates in Agricultural Waste Waters, Federal Water Quality Administration Water Pollution Control Research Series 13030 ELY, 12/69, p 143-155, December 1969. 13 p, 4 fig, 4 tab, 3 ref. FWQA Project 13030 ELY.

Descriptors: *Algae, *Waste water treatment, *Water pollution control, *Denitrification, *Biodegradation, *Drainage water, California, Drainage programs, Anaerobic bacteria, Anaerobic conditions, Lagoons.
Identifiers: *Central Valley (California), *Bacterial denitrification.

Laboratory culture experiments were made to determine the effectiveness of the two biological processes under investigation, algal stripping and bacterial denitrification, for removing the algal growth potential of the tile drainage water when added to potential receiving waters in the Sacramento-San Joaquin Delta. Algal growth potential tests in two different laboratories indicate that nitrate-rich agricultural drainage, when mixed with San Joaquin River Delta water, stimulates algal growth. Selective removal of nitrate-nitrogen by anaerobic denitrification or removal of nutrients by algal cells grown in shallow ponds yielded comparable bioassay results. Eutrophication due to agricultural waste waters can be controlled by treatment. (See also W71-04546) (Knapp-USGS)
W71-04555

HARVESTING OF ALGAE GROWN AGRICULTURAL WASTE WATERS,
California State Dept. of Water Resources, F and Bureau of Reclamation, Fresno, Calif.
Bruce A. Butterfield, and James R. Jones.
In: Collected Papers Regarding Nitrates in Ag tural Waste Waters, Federal Water Qualit ministration Water Pollution Control Resear ries 13030 ELY, 12/69, p 157-163, Dec 1969. 7 p, 1 tab. FWQA Project 13030 ELY.

Descriptors: *Algae, *Waste water trea *Water pollution control, *Denitrific *Biodegradation, *Drainage water, Calif Drainage programs, Anaerobic bacteria, A bic conditions, Lagoons.
Identifiers: *Algae harvesting, *Central (Calif.).

Through laboratory and field testing of alga vesting methods for denitrification, it was that effective concentration can be accomp using the flocculation-sedimentation proce remove 90-95 percent of the suspended solids algae-laden agricultural waste water. Dewa and drying can be accomplished but the eff cies of the units tested were low. The need to culate the water would increase the overall however, it is believed better results wi achieved in larger capacity units. (See also 04546) (Knapp-USGS)
W71-04556

COMBINED NUTRIENT REMOVAL TRANSPORT SYSTEM FOR TILE DRAIN FROM THE SAN JOAQUIN VALLEY,
California State Dept. of Water Resources, Fr and Federal Water Quality Administration, Fr Calif.; and California Univ., Berkeley. Dep Sanitary Engineering and Public Health.
Joel C. Goldman, James F. Arthur, William J. Oswald, and Louis A. Beck.
In: Collected Papers Regarding Nitrates in Ag tural Waste Waters, Federal Water Quality ministration Water Pollution Control Researc ries 13030 ELY, 12/69, p 165-186, Dece 1969. 22 p, 4 fig, 1 tab, append. FWQA Pr 13030 ELY.

Descriptors: *Algae, *Waste water treatm *Water pollution control, *Denitrifica *Biodegradation, *Drainage water, Califo Drainage programs, Anaerobic bacteria, An bic conditions, Lagoons.
Identifiers: *Algae harvesting, *Central V (Calif.).

Current plans call for treatment of agricul waste water for nutrient (nitrogen) removal the proposed San Luis and Master Drains pri discharge into the Bay-Delta Area. Of the se treatment processes being investigated, the a stripping process is estimated to require betw 6,000 and 12,000 acres of land to accomplish task. Because every body of water is a pote algal growth system, there are several alterna which will greatly reduce the total cost of treatm and perhaps improve the overall efficiency nutrient removal. In-Line Treatment using drain and the drainage reservoirs for algae gr may be an economical and practical method nutrient removal. Because Kesterson Reservo an integral part of the proposed drainage sy and contains the required area needed for t ment by algae stripping, it seems logical to use a dual-purpose treatment and storage reser Kesterson Reservoir, if modified as suggested, the potential to provide nitrogen removals in ex of 90%. (See also W71-04546) (Knapp-USGS)
W71-04557

CONCEPTUAL ENGINEERING REPORT KINGMAN LAKE PROJECT.
Weston (Roy F.) Inc., West Chester, Pa.

Copy available from GPO Sup Doc I67.13/4:11023FIX, $1.25; microfiche from N

PB-197 598, $0.95. Water Pollution Control
earch Series 11023 FIX 08/70, August 1970.
p, 23 tab, 7 fig, 25 ref, 5 append.

criptors: *Activated carbon, Adsorption, Com-
ed sewers, District of Columbia, *Overflows,
lution abatement, Precipitation (Rainfall),
reation facilities, *Water storage, *Water
amation, *Waste water treatment, *Treatment
ts, Cost benefits, Costs, Cost allocation, Feasi-
y studies, Project feasibility.
tifiers: *Combined sewers.

conceptual engineering study concerns the
mation of combined sewer overflows and
zation of the reclaimed waters in a major water-
ted recreational facility for the District of
mbia. The investigation encompasses a com-
ensive solution of environmental problems by
osing multi-use objectives and facilities. Prin-
objectives of the project included: (1) evalua-
of rainfall runoff relationships for sizing of
ge and treatment plant capacities; (2) confir-
on of treatment feasibility using filtration and
tivated carbon process; and (3) development
fficient data for preliminary design purposes.
ratory studies not only demonstrated process
bility, but showed the need for including floc-
ion and sedimentation for removal of minute
cles, together with chlorine and iodine addi-
or maximum disinfection. The recommended
ge/treatment plant provides for a 175 million
storage basin, a 50 million-gallon-per-day
nation facility and two 46-acre swimming and
ng lakes. Cost effectiveness (Cost/Benefit
) of the project, as envisioned, has been in-
d to be 1.6 at an estimated total project cost
5,200,000, and an estimated annual operating
of $1,777,000. Implementation of the
sed plan would not only provide a least-cost
ative over single-purpose projects to attain
cal objectives, but would also reduce the an-
pollution now discharged by the Northeast
lary Trunk Sewer by approximately 99 per-

04616

**DY OF FLOW REDUCTION AND TREAT-
OF WASTE WATER FROM
EHOLDS,**
al Dynamics Corp., Groton, Conn. Electric
iv.
ailey, R. J. Benoit, J. M. Robb, and H.
an.
available from GPO Sup Doc as I67.13/4
FKE, $1.25; microfiche from NTIS as PB-
9, $0.95. Water Pollution Control Research
11050 FKE, Dec 1967. 154 p, 18 fig, 23 tab,
. FWQA Program 11050 FKE.

tors: *Water conservation, *Water de-
*Water pollution, *Water resources,
storage, Water utilization, Water consump-
ater loss, Waste disposal, Domestic water,
Pipes, Water reuse, Water quality, Flow,
disposal, Anaerobic, Aerobic, Municipal
Waste water treatment.
ers: *Recycle, *Urinals, *Water saving fau-
ater saving showerheads, Individual treat-
stems, Liljendahl vacumm system.

erature on household water quantity and
requirements was reviewed, an average
se pattern postulated, and the amount of
ed in various household functions was esti-
Comparisons of different water saving
were made on a cost basis. Water quality is
ed from three points of view: health,
cs, and engineering suitability. The future
mands may necessitate very strict disposal
ents and multiple water quality levels
the present standards do not tend to allow
of several levels of water quality such as
ndering effluent for toilet flushing. Waste
problems of homes not connected to cen-
rage systems were discussed. Septic tanks,
f phase processes, membrane processes,
tic processes, and other processes were evaluated, mainly on a cost basis. Most of the methods considered do not appear to be suitable for individual households at this time but with changes in economic factors and technical improvements some of these methods may be attractive for future use. A survey of homeowners, architects-engineers, plumbers and plumbing equipment manufacturers was conducted to obtain representative reactions to methods used to control water quantity and quality and waste water treatment processes. It was found through these surveys that opinions formed from the literature survey was not contrary to popular practices and beliefs. (Ellis-Texas)
W71-04617

A NEW DEVICE FOR WASTE WATER TREATMENT SLUDGE CONCENTRATION,
Smith and Loveless, Lenexa, Kans.
Brian L. Goodman, and Robert B. Higgins.
Water and Wastes Engineering, p 30-32, August 1970. 3 fig.

Descriptors: *Waste water treatment, *Sludge treatment, Activated sludge, Anaerobic digestion, Dewatering.
Identifiers: *Sludge concentrator, Smith and Loveless (Lenexa, Kans).

Research pertinent to dehydration of solids yielded a new waste water treatment employing the S and L Sludge Concentrator. This device utilizes gravity and pressure dewatering to increase the content of solids of sludges prior to their disposal. The concentrator includes a feed pump, polymer system, sludge thickener, and a two-stage dewatering unit. The equipment can be utilized in a variety of waste water treatment processes, such as activated sludge, sludge drying beds, and anaerobic digestion. The cost for chemicals have been in the range of $5 to $15 per ton of dry solids; the cost for electric current is about 16 cents per hour of operation. (Wilde-Wisconsin)
W71-04622

ECONOMICS OF TREATING SEWAGE AND TRADE WASTES,
Babtie, Shaw and Morton, Glasgow (Scotland).
R. M. Bradley.
Effluent and Water Treatment Journal, p 526-530, 1970. 1 fig, 4 tab, 19 ref.

Descriptors: *Sewage treatment, *Sewage effluents, Population, Oxidation lagoons, Filtering systems, Cost comparisons, Economic feasibility, Industrial wastes, Municipal wastes.
Identifiers: *Packaged treatment plants, Plastic media filters, England, Small populations.

Both capital and operating costs of sewage treatment are analysed with the conclusion that some unconventional types of sewage treatment (packaged treatment plants) serving populations less than 1000 are economical. Comparative costs of treatment by biological filtration, oxidation ditch, and packaged plants are given. On-site industrial sewage plants are more economically operated than those of equivalent capacity for municipal sewage works, according to cost breakdowns. Although unconventional types of sewage treatment are associated with industrial wastes, they would be feasible for municipal waste processing. Recent operational results indicate that oxidation ditches produce a consistently satisfactory effluent although operational costs are higher than for conventional works but the more reliable effluent quality at such low population cost is compensatory; especially when debt charges are considered, the advantage of both oxidation ditches and packaged plants becomes even more attractive. High-rate biological filters using plastic media have their bigger impact for on-site industrial waste treatment and for relief of overloaded existing systems and reduction in land area. Data shows that industrial treatment plant construction is 50% of equivalent municipal sewage works. (Auen-Wisconsin)
W71-04623

PROTOZOA IN BIOLOGICAL SEWAGE-TREATMENT PROCESSES--I. A SURVEY OF THE PROTOZOAN FAUNA OF BRITISH PERCOLATING FILTERS AND ACTIVATED-SLUDGE PLANTS,
Water Pollution Research Lab., Stevenage (England).
C. R. Curds, and A. Cockburn.
Water Research, Vol 4, p 225-236, 1970. 3 fig, 2 tab, 12 ref.

Descriptors: *Activated sludge, *Waste treatment, *Protozoa, Filters, Industrial wastes.
Identifiers: *Ciliated protozoa, *Percolating filters, England, Scotland, Ciliates, Flagellates, Amoeba.

Microscopic examination of effluent from percolating filters and mixed liquor from activated-sludge plants revealed a predominant presence of ciliated protozoa and occasional occurrence of flagellated protozoa and amoebae. A complete list of species with their abundance and frequency of occurrence is included. Effluents of high quality, delivered by activated-sludge plants, contained a large variety and numbers of ciliated protozoa. Low quality turbid effluents of other activated-sludge plants were free from ciliates of contained only small numbers of a few species. The study failed to disclose any particular component of industrial effluents that is responsible for suppression of protozoan population. (See also W71-04628) (Wilde-Wisconsin)
W71-04627

PROTOZOA IN BIOLOGICAL SEWAGE-TREATMENT PROCESSES--II. PROTOZOA AS INDICATORS IN THE ACTIVATED-SLUDGE PROCESS,
Water Pollution Research Lab., Stevenage (England).
C. R. Curds, and A. Cockburn.
Water Research, Vol 4, p 237-249, 1970. 4 fig, 4 tab, 14 ref.

Descriptors: *Sewage treatment, *Activated sludge, *Sludge digestion, Protozoa, Biochemical oxygen demand, Effluents, Indicators, Measurement.
Identifiers: *Ciliate protozoa, Sludge loads, Holotrichs, Peritrichs, Hypotrichs.

Activated sludges with loading below 0.3 BOD/g mixed liquor suspended solids per day contained the largest number of holotrichs, peritrichs, and hypotrichs, nearly equally distributed. However, the structure of protozoan communities in activated sludges appeared to be influenced by the BOD of the effluent. In turn, a correlation was established between the average effluent quality within the ranges of 0-10, 11-20, 21-30, and -30 mg/l and the taxonomic contents of the sludge. An application of the relationship to other sites proved to be correct in 83% of cases. (See also W71-04627) (Wilde-Wisconsin)
W71-04628

A STUDY OF NITRIFICATION AND DENITRIFICATION,
Envirogenics Co., El Monte, Calif.
Byron J. Mechalas, Paul H. Allen, III, and Walter W. Matyskiela.
Copy available from GPO Sup Doc as I67.13/4:17010 DRD 07/70, $1.00; microfiche from NTIS as PB-197 658, $0.95. Water Pollution Control Research Series 17010 DRO 07/70, July 1970. 90 p, 13 tab, 37 fig, 8 ref. FWQA Program No 17010 DRD.

Descriptors: *Denitrification, *Mathematical models, *Nitrates, *Nitrification, Aerobic conditions, Chemical oxygen demand, Evaluation, Laboratory tests, Nutrients, Organic loadings, Oxygen requirements, *Waste water treatment, Tertiary treatment, Temperature, Biological treatment, Costs.
Identifiers: Residence time, Limiting substrate.

A program to incorporate biological denitrification into a waste water treatment system was un-

dertaken with the objective of developing a process that depends exclusively on the carbon compounds contained in the waste water to supply metabolic energy to the microflora. In the experimental program the incoming nitrogenous material was oxidized to nitrate in an aerobic phase and reduced to nitrogen gas in an anaerobic phase. Conditions for developing a nitrifying microflora were investigated using a primary waste water effluent as feed. Flows into the system were varied to give a range of residence times. Anaerobic batch experiments were carried out to determine if stored reserves could support denitrification. Under appropriate conditions almost 100% of the nitrates could be reduced. The effluent from the aerobic unit served as the feed for the anaerobic process. At appropriate intervals this situation was reversed by switching the airflows and feed sources. Over 95% of the waste water nitrogen in waste water was removed. Nitrate-nitrogen removal rates ranged from 0.600 to 1.00 mg/hr/g MLVS. A mathematical model was developed which described the response to cycled aerobic-anaerobic operation. The alternating cycle approach was shown to be an effective method for removing nitrogen from waste water. (Mechalas-Aerojet)
W71-04667

COMBINED SEWER TEMPORARY UNDERWATER STORAGE FACILITY.
Melpar, Falls Church, Va.

Copy available from GPO Sup Doc as I67.13/4:11022 DPP 10/70, $1.75; microfiche from NTIS as PB-197 669, $0.95. Water Pollution Control Research Series 11022 DPP 10/70, October 1970. 75 p, 12 tab, 16 fig, 2 ref. FWQA Program 11022 DPP.

Descriptors: Storage, *Overflow, *Storm runoff, *Storage tanks, Sewers, Interception, Drainage, *Pumped storage, Costs, *Pumping plants, Maryland.
Identifiers: *Combined sewers, Cambridge (Md), Choptank River, *Underwater storage.

A pilot plant underwater storage facility was designed, constructed, operated and evaluated as a method of temporarily storing storm overflow from the combined sewer of the Choptank Avenue drainage basin, Cambridge, Maryland. Combined sewage in excess of the sewer capacity, which would normally be discharged directly into the Choptank River, was intercepted and pumped into a nominal 200,000 gallon flexible underwater storage container located 1300 feet offshore. The stored overflow was later returned from the tank at a rate which could be accommodated by the intercepting sewer and treatment plant. The facility was tested with overflow both from four naturally occurring rainfalls and using fresh water simulation. The overflow samples were analyzed in a field laboratory for the following characteristics: pH, suspended solids, volatile suspended solids, settleable solids, 5 day biochemical oxygen demand, and chemical oxygen demand. The pilot plant facility was capable of collecting 96 percent of the average annual overflow from the drainage basin at a cost of less than $1.85 per thousand gallons. The facility could prevent the annual discharge of 7,136 pounds BOD into the Choptank River. Underwater storage facilities could be used effectively for a number of combined sewer areas. Site selection, however, has been proven to be a critical factor. Care must be exercised to prevent public disturbance, and factors such as land use, tidal conditions, or the types of storms, must also be considered. (Meloy-Melpar)
W71-04668

REVERSE OSMOSIS RENOVATION OF MUNICIPAL WASTE WATER.
Aerojet-General Corporation, El Monte, Calif. Environmental Systems Div.

Copy available from GPO Sup Doc as I67.13/4:17040 EFQ 12/69, $1.50; microfiche from NTIS as PB-197 659, $0.95. Water Pollution Control Research Series ORD-17040 EFQ 12/69, 1969. 160 p, 12 tab, 107 fig. FWQA Program 17040 EFQ. Contract No 14-12-184.

Descriptors: *Reverse osmosis, *Sewage treatment, Tertiary treatment, Computer models, *Membrane processes, Demineralization, *Osmosis, *Waste water treatment, Municipal water, Solid wastes, Organic wastes, Costs.
Identifiers: Process models, *Municipal waste water, Solids removal, Organics removal.

A fifteen-month laboratory program has shown that all grades of municipal waste water may be significantly improved by the reverse osmosis process. Comparisons are provided on the behavior and response of the reverse osmosis process to carbon-treated secondary sewage, alum-treated secondary sewage, secondary sewage, primary settled sewage, raw sewage, and digester supernatant. High removals of dissolved minerals, organic substances, and suspended matter have all been achieved in the same treatment. The effects of a flocculant, dispersant, chelating agent, enzyme, and acid on reducing product water flux decline are compared. The relative effects of reverse osmosis test-cell geometry on solids deposition and membrane performance are presented. A phenomenological model is postulated describing the role of undissolved solids and organic substances in producing product water flux decline and the subsequent maintenance of constant product water fluxes. A computer model of the reverse osmosis process, compatible with the executive program written by the Federal Water Quality Administration, has been developed to provide an accurate and rapid method of determining the design and cost of reverse osmosis facilities. (Feuerstein-Aerojet-General)
W71-04669

APPLICATION OF HYPERFILTRATION TO TREATMENT OF MUNICIPAL SEWAGE EFFLUENTS,
Oak Ridge National Lab., Tenn. Water Research Program.
Kurt A. Kraus.
Copy available from GPO Sup Doc as I67.13/4:17030 EOH 01/70, $0.70; microfiche from NTIS as PB-197 671, $0.95. Water Pollution Control Research Series 17030 EOH 01/70, January 1970. 71 p. FWQA Program 17030 EOH.

Descriptors: Waste water treatment, *Filtration, *Membranes, Membrane processes, Effluents, Municipal wastes, Sewage effluents, *Sewage treatment, *Electrolytes, Ion exchange.
Identifiers: *Hyperfiltration, Membrane additives.

A large number of membranes dynamically formed from polyelectrolytes on fine-grained (ca. 0.5 micron) supports or filters were tested for application in hyperfiltration of effluents from the primary and secondary stages of a municipal sewage treatment plant. Since results with primary effluents were not significantly different from those with secondary, most of the later studies were limited to primary effluents. The dynamic membranes were principally examined for salt rejection, organic rejection, flux, and flux decline with time. Cation-exchange membranes formed from anionic polyelectrolytes were generally superior to anion exchange membranes from polycations. Membranes formed from (unidentified) sewage constituents, while rejecting salts and organic materials, seemed inferior to separately formed dynamic cation-exchange-active membranes. In earlier studies, membrane additives were continuously supplied to the feeds. In later runs, which extended to several weeks operation at the sewage plant, such continuous addition did not seem required, at least for some of the more promising membrane additives tested, such as those formed from homogenized Dowex-50, homogenized Sephadex, and for a dual-layer membrane composed of hydrous zirconium oxide and polyacrylic acid. With these membranes, upward of 50% salt rejection was frequently found, together with higher alkaline earth and organic rejections at initia
of 100 gfd and higher. Salt rejection in ex
50% at fluxes in excess of 50 gfd were found
of the cases after 20 hours operation. At hig
lation velocities (larger than 20 ft/sec), flux
was usually modest, and fluxes in excess of
were often observed after two weeks' operat
W71-04671

TOTAL WATER USE.
Santee County Water District, Calif.

Project construction was jointly financed
Santee County Water District and the
Water Pollution Control Administration, D
the Interior. Santee County Water District
16 p, 34 fig.

Descriptors: *Reclaimed water, *Water
*Sewage treatment, *Waste water tre
*Water conservation, *Water costs,
shortage, Recreation, Oxidation lagoon
nicipal wastes, Water resources develo
California.
Identifiers: *Santee County Water District,
sludge disposal process.

The recently constructed $2,223,944 wast
reclamation plant of the Santee County Wa
trict is recognized as being the most ad
facility of its kind in the world. The plant,
only 14,500 persons, was built in lieu of
with other nearby communities in for
metropolitan sewer system designed for dis
waste water into the Pacific Ocean. The
reason for the adoption of a water recla
system was the extremely high cost of mu
water which is presently imported fro
Colorado River, more than 300 miles. The
completed in January 1968, consists of
sewage pump station, a 3.2-mile long sewag
main, an activated sludge treatment plant co
with sludge disposal facilities plus an ox
pond, an effluent pump station, and a 1.9-m
effluent distribution force main, all of whic
integral part of the existing recreational la
water reclamation facilities. The raw se
pumped up Sycamore Canyon for processin
new treatment plant. The effluent flows bac
the canyon through an oxidation pond and
ing basins, and thence is filtered through
underground aquifers into the recreation
system from which effluent for distribu
pumped. The reclaimed water is used for
tional, agricultural and industrial purposes.
treatment and disposal is accomplished by
air oxidation (Zimpro) process. The entir
mation system is described and photograp
diagramatic sketches are included. (Poertne
W71-04680

CHARACTERIZATION, TREATMENT, DISPOSAL OF URBAN STORMWATER,
Robert A. Taft Sanitary Engineering Cent
cinnati, Ohio.
S. R. Weibel, R. B. Weidner, A. G. Christian
and R. J. Anderson.
Proceedings of the Third International Con
on Water Pollution Research, Munich, Ge
1966, p 329-343. 1 fig, 6 tab, 29 ref.

Descriptors: *Storm runoff, *Precip
*Chlorinated hydrocarbon pesticides, N
Phosphorous, Chlorides, Ammonia, *Co
Bioassay, Chlorination, Biochemical oxy
mand, Chemical oxygen demand, Ohio,
water treatment, Water pollution control.
Identifiers: Surface wash, Fecal strepto
*Fecal coliforms, Thresholds, Suspended
Volatile suspended solids, Cincinnati (Ohio

Increasing demand for water supplies, and
demand for pollution abatement has led to
of the part played by precipitation and stor
runoff. Inorganic nitrogen and hydro
phosphate concentrations in rainwater wer
to be .69 mg/l and 0.24 mg/l respectively: b

ceed Sawyer's threshold level for algal bloom. In addition, several different chlorinated organic hydrocarbon pesticides have been isolated and identified in rainfall at Cincinnati. Several water quality parameters of stormwater runoff were also investigated. Coliform densities greater than 2900/100 ml were found in 90% of the samples tested, high above the 1000/.100 ml standard applied for recreational water. Stormwater runoff also contains a high level of suspended solids, many of which are not amenable to removal by sedimentation. During runoff, stormwater runoff constituent discharge rates, expressed as percentage of average raw sewage constituent production rates at population density of 9 persons/acre are: suspended solids; 2400%, COD;520%, BOD, 110% total hydrolyzable phosphate, 70%; and total nitrogen, 200%. From this analysis it is obvious that although stormwater runoff must contribute to water supplies in the future, it will require extensive treatment before it is fit for use as a potable water source. (Ellis-Texas)
W71-04687

ETERMINATION OF ACTIVATED SLUDGE CTIVITY-A POSSIBILITY OF CONTROLLING CTIVATED SLUDGE PLANTS,
uhrverband, Essen (West Germany).
/ilheim Bucksteeg.
roceedings of the Third International Conference n Water Pollution Research, Munich, German, 966, p 83-94. 7 fig, 4 ref.

escriptors: *Colorimetry, *Biodegradation, *Incator, Efficiency, Purification, Reduction, iochemical oxygen demand, Activated sludge, Sludge treatment, Waste water treatment.
entifiers: 2-3-5-Triphenyletrazolium chlordie, rtinction, Red formzaone, Damping intensity, mpirical, Mixed liquor, KMnO4demand.

n activated sludge process can be regulated solely the basis of organic load and sludge activity. In is way, sludge concentration, expressed as the acity can be adjusted for maximum efficiency durg either maximum load, or the 24 hour average ad. The activity of dehydrogenases of the acated sludge responds so fast that a relationship tween the activity and the loading can be tablished over as short as a two hour period. nce activity, Y, is determined by the dry sludge ss, x, and the organic loading, and there is a rect relation between Y and the purification efct, a, then the purification efficiency per unit lume is obtained by multiplying x by a. Therere, because of the inter-relations, a, can be obned when both x and y are known. Careful moniing of x versus y and the sludge volume index alvs operators to quickly determine what the conion of the sludge inside the tank is, and hence an erator can prevent failure by spotting slugs of ic material which may be entering the process. e also W71-04689 and W71-04690) (Lowry-xas)
71-04688

SCUSSION OF 'DETERMINATION OF AC-VATED SLUDGE ACTIVITY-A POSSIBILITY CONTROLLING ACTIVATED SLUDGE ANTS,'
draulic Research Inst., Prague (Choslovakia).
os Effenberger.
ceedings of the Third International Conference Water Pollution Research, Munich, Germany, p 97. 2 fig, 1 tab, 6 ref.

criptors: *Pilot plant, *Incubation, Activated dge, Dissolved oxygen, Biochemical oxygen dend, *Sludge treatment, Waste water treatment.
ntifiers: TTC, Dehydrogenase, Total activity, cific activity, HURD, INKA, Triphenyl forzone, Aeration tank, Mixed liquor.

ifference in the level of turbulence will cause a erence in the level of biological activity in an vated sludge tank. However, measurements must be taken at the temperature at which the aeration tank is operating. If a different temperature is used to incubate the samples then results cannot be considered accurate. Lenhard, Nourse, and Schwartz recommend adjusting the pH of the solution during the standard test but this would cause the conditions to deviate from actual aeration tank conditions. Enzymic activity depends on the fact that the enzyme proteins are polyvalent dipolar ions which can exist in a number of forms depending upon the pH value of the substrate. Some of these forms are more active than others, resulting in considerable experimental error. Biological population changes in response to changes in the organic loading. Generally lower loads were characterized by protozoal sludge, while higher levels of loading resulted in bulking or filamentous sludge. A pilot plant activated sludge unit was operated in order to establish the relationship between total dehydrogenase activity and oxidation-reduction potential. The samples were kept at the temperature of the mixed liquor in the aeration tank. Dissolved oxygen content varied between 1 and 2 mg/l. Increasing dehydrogenase activity resulted in decreased oxidation reduction potential in the mixed liquor. However, the gradient of the line expressing the relationship of the two values was given by the technical and technological conditions of the activated sludge process. (See also W71-04688) (Lowry-Texas)
W71-04689

DISCUSSION OF 'DETERMINATION OF ACTIVATED SLUDGE ACTIVITY-A POSSIBILITY OF CONTROLLING ACTIVATED SLUDGE PLANTS',
Research Inst. for Water Resources Development, Budapest (Hungary).
P. Farkas.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 98-102. 2 fig, 2 tab.

Descriptors: *Biodegradation, *Incubation, Diffusion, Bacteria, Metabolism, Biochemical oxygen demand, Activated sludge, *Sludge treatment, Waste water treatment.
Identifiers: TTC, Formazone, *Endogenous respiration, Staining, Zoogloeal, MLSS, Biological load.

The TTC method for determining the 'activated sludge activity' reveals several different factors pertinent to the operation of an activated sludge plant. First of all, the TTC method can be used to determine the biological degradability of a particular substrate. The substrate activity, Y, depends on the organic loading. The increase in activity of a sludge in the endogenous respiration stage characterizes the activity of the substrate that was added. From these conclusions, it is obvious that the concentration of the active mass, Ma, if well estimated, may offer a far better design base that the conventional MLSS. Secondly, the TTC method was used to determine the accessability of oxygen to all parts of the sludge. TTC in the presence of oxygen is not reduced, so addition of TTC to a sludge blanket will result in stained sections only where the oxygen is not able to reach. This provides useful information concerning power levels and mixing intensity. Finally, TTC can be used to check the effluent quality of treatment plants. Overloading of an activated sludge installation results in dispersed growth of bacteria and poor settling characteristics. When incubated with TTC, poor quality effluents exhibit a purple color, the intensity of which is directly related to the number of free-swimming bacteria. (See also W71-04688) (Lowry-Texas)
W71-04690

NONIONIC DETERGENTS AND RELATED SUBSTANCES IN BRITISH WATERS,
Ministry of Technology, London (England). Lab. of Government Chemist.
Stella J. Patterson, K. B. E. Tucker, and C. C. Scott.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 103-116. 2 fig, 4 tab, 10 ref.

Descriptors: *Degradation, *Detergents, *Foaming, Chromatography, Chemical analysis, Sewage, Effluents, Industrial wastes, Waste water treatment, Biodegradation, Aromatic compounds, Linear alkylate sulfonate.
Identifiers: *Polyglycols, *Nonionic detergents, *Anionic detergents, Aire River, Calder River, Synergism, Alkyl phenol-9-ethylene oxide.

Thin layer chromatographic techniques were developed to analyze river water for the presence of nonionic and anionic detergents and also polyglycols. Chromatographic techniques were used since none of the available chemical processes had the sensitivity required. It was found that 'hard' nonionic material and polyglycols degrade very slowly, and much residual concentration is present even after considerable time has passed. 'Soft' nonionic materials, on the other hand, degrade very rapidly and present little problem. The majority of rivers analyzed contained .01 mg/l or less of nonionic detergents while 3 rivers serving highly industrialized areas contained between .1 and .25 mg/l. Anionic detergents ranged from .1 to 1.8 mg/l with an average of .4 mg/l. In view of the synergistic effects which such detergents are known to possess, suitable combinations of detergents of this level can, and in fact do cause serious foaming problems. (See also W71-04692 thru W71-04694) (Ellis-Texas)
W71-04691

DISCUSSION OF 'NONIONIC DETERGENTS AND RELATED SUBSTANCES IN BRITISH WATERS',
Federal Water Pollution Control Administration, Cincinnati, Ohio.
M. B. Ettinger.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 112. 3 ref.

Descriptors: *Detergents, *Linear alkylate sulfonate, *Aromatic compounds, Biodegradation, Biochemical oxygen demand, Waste water treatment, Chromatography.
Identifiers: *Polyglycols, Alkyl alcohol ethoxides, Nonionic detergents, Phenol derivatives, Alcohol derivatives, Aromatic ethoxides.

Degradation of polyglycols or nonionic detergents does not necessarily mean that there will be no remaining residues with surface active properties or other undesirable characteristics. The extraction procedure and the extract washing procedure used in thin-film chromatographic analysis seem unlikely to recover many glycol chain residues which have been shown to be at least moderately resistant to biodegradation. Field studies at treatment facilities revealed some penetration by biodegradable materials of five different secondary sewage treatment systems. Therefore adequate treatment will not completely solve the problem. (See also W71-04691) (Lowry-Texas)
W71-04692

DISCUSSION OF, 'NONIONIC DETERGENTS AND RELATED SUBSTANCES IN BRITISH WATERS',
Koniklijke/Shell-Laboratorium, Amsterdam (Netherlands).
P. L. Kooijman.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 113-114. 1 ref.

Descriptors: *Chromatography, *Detergents, Biodegradation, Waste water treatment.
Identifiers: Chloroform extraction, Cobalto thiocyanate method, Polyethylene glycol, Ethylene oxide, Carboxylate.

The cobalto-thiocyanate method color formation with nonionics is dependent upon the ethylene oxide content of the nonionics. If the ethylene oxide chain of a nonionic is shortened by biological attack, the resultant product may intensify the color of the complex, thus resulting in considerable error. The thin layer chromatographic method is not subject to error from this source. Thin layer chromatograms have distinguished between nonionic and polyethylene glycol. If complete separation is possible, it should be possible to analyze intermediate products of biodegradation. (See also W71-04691) (Lowry-Texas)
W71-04693

DISCUSSION OF 'NONIONIC DETERGENTS AND RELATED SUBSTANCES IN BRITISH WATERS',
Monsanto Co., St. Louis, Mo.
R. D. Swisher.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 114-115. 4 ref.

Descriptors: Detergents, Biodegradation, *Surfactants, Waste water treatment, Chromatography.
Identifiers: Chloroform extraction, Polyglycols, Alkylphenon ethylene oxide, Carboxylate, Hard nonionic detergents, Soft nonionic detergents.

Several factors have combined to hamper the study of the biodegradation of nonionic surfactants, and the detection of their presence in water. The surfactants are present only in extremely dilute solution when compared to potentially interfering materials. In addition, biodegradation itself proceeds through a series of steps involving many times the formation of complicated complexes which are difficult to monitor in their degradation processes. A degrading system may contain not only the original molecules, but hosts of new and different compounds to confuse the issue still further. Other compounds may be more easily extracted with chloroform resulting in considerable error in the resulting thin film chromatographs. Therefore, it would seem that thin film chromatography must undergo further research and development before being regarded as a precise investigative tool. (See also W71-04691) (Lowry-Texas)
W71-04694

AEROBIC SLUDGE STABILIZATION IN SEWAGE TREATMENT PLANTS,
Technische Hochschule, Hanover (West Germany).
Dietrich Kehr.
Proceedings of the Third International Conference, Munich, Germany, 1966, p 143-152. 7 fig, 19 ref.

Descriptors: *Biodegradation, *Digestion, Organic loading, Microorganisms, Nitrogen, Phosphorus, Biochemical oxygen demand, Industrial wastes, Municipal wastes, *Sludge, Sewage treatment, Waste water treatment.
Identifiers: *Aerobic sludge stabilization, Technical digestion limit, Stabilized sludge, Sludge age, Sludge load.

Aerobic sludge stabilization and its economic and technical aspects have been investigated as a substitute for the use of large digesters employed in the anaerobic digestion process. The general design basis of design of an aerobic stabilization tank is .01 cubic meters/capita, or approximately 30% of the volume of a digester designed for the same load. On the other hand, aerobic stabilization requires energy in the form of pumping and compressors required to put oxygen into the system, whereas anaerobic digestion produces usable energy. Therefore a cost comparison of the two methods should be made in every case in order to determine which is less expensive. Sewage treatment plants serving 10,000 people or less are in many instances already employing joint activated sludge waste treatment and sludge stabilization. Indications are that separate processes are feasible for plants serving up to 100,000 people, if the cost of electrical power is less than 1.2 cents/kw hour. (See also W71-04696 thru W71-04698) (Lowry-Texas)
W71-04695

DISCUSSION OF 'AEROBIC SLUDGE STABILIZATION IN SEWAGE TREATMENT PLANTS',
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia).
Jan Chudoba.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 153-157. 1 fig, 17 ref.

Descriptors: Digestion, Synthesis, Kinetics, Stabilization, Organic loading, Biodegradation, Chemical oxygen demand, Biochemical oxygen demand, Activated sludge, Water purification, Sewage, Aeration, Waste water treatment.
Identifiers: *Endogenous metabolism, *Sludge yield coefficient, *Sludge age, *Extended aeration, Volatile suspended solids, Mixed liquor suspended solids.

Two methods of aerobic sludge stabilization are presently employed in practice. Extended aeration has long been practiced, and for it to operate optimally, the following guidelines must be followed. Detention time in the aeration tank must be 24 hours, followed by 4-6 hour sedimentation time, while the organic loading must be from 240-320 g BOD5/day/cubic meter and the sludge loading cannot exceed .1 g BOD5/day/g Vss. Problems which occur are mainly due to poor sludge settleability, causing much of the organic material to pass through the outlet in the form of suspended solids. Formulae have been developed to determine the amount of non-degradable material which will remain, and the amount of degradable material which will be oxidized. The second method consists of separate aeration of sludges under continuous or discontinuous conditions. For this type of treatment, the aeration period is a function of certain sludge characteristics, notably the volatile suspended solids content. Experiments showed that higher volatile solids removals were effected at the lower loading rates. Temperature is also a significant factor. The higher the loading rate, the less the sludge will settle, and this usually requires installation of some additional sludge handling device, or separate sludge aeration tank. (See also W71-04695) (Lowry-Texas)
W71-04696

DISCUSSION OF 'AEROBIC SLUDGE STABILIZATION IN SEWAGE TREATMENT PLANTS',
Texas Univ., Austin.
Joseph F. Malina, Jr.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 157-160. 1 tab, 4 ref.

Descriptors: *Anaerobic digestion, *Aerobic treatment, *Stabilization, Organic loading, Degradation, Synthesis, Microorganisms, Ammonia, Oxidation, Activated sludge, Waste water treatment.
Identifiers: *Primary sludge, Oxygen consumption, Detention Time, Volatile solids.

Much data has been accumulated to determine the relative merits of aerobic versus anaerobic sludge stabilization. The data presented here show significant advantages for the anaerobic method when dealing with primary sludge. The anaerobic process has a much lower growth rate, consequently more of the organic material is destroyed rather than synthesized into new cell material. Carbon removals and ammonia nitrogen production also achieved much higher levels in the anaerobic process. The amount of volatile solids destroyed anaerobically increased with increased organic loading, whereas the amount destroyed aerobically remained essentially constant. When dealing with waste activated sludge, however, the outlook is much changed. The much lower content of volatile solids and higher difficulty of degrading products which are already fairly well stabilized m
utilization of anaerobic treatment, although p
ble, economically unfeasible in the degradatio
waste activated sludge. Therefore, the dec
between aerobic and anaerobic treatment ca
be based solely on the systems themselves, but
also be a function of the waste to be treated.
also W71-04695) (Lowry-Texas)
W71-04697

**DISCUSSION OF 'AEROBIC SLUDGE S
BILIZATION IN SEWAGE TREATM
PLANTS',**
Kurita Central Labs., Yokohama (Japan).
Minoru Okazaki, and Jenji Kato.
Proceedings of the Third International Confer
on Water Pollution Research, Munich, Germ
1966, p 160-163. 2 fig, 1 tab.

Descriptors: *Aerobic treatment, *Stabiliza
*Odor, Orthophosphorous compounds, Res
tion, Biodegradation, Organic loading, Mic
ganism, Activated Sludge, Waste water treatme
Identifiers: *Reductase activity, Japan.

The Japanese have found that aerobic sludge
bilization plants are more easily constructed
operated, but their increasing prevalence in
country has been attributed to their lack of o
tionable odors. Batch-type laboratory scale stu
of activated sludge have revealed that the relea
phosphate into sludge liquor is parallel to
progress of sludge stabilization and also to
reduction of the oxygen uptake rate. Sludge
centration cannot be considered a constant sin
increases with each nutrient feeding of an activ
sludge reactor. The higher the sludge concen
tion the higher the nutrient decomposition rate
thus sludge stabilization rate. This sludge incr
cannot go on indefinitely, since each successive
increases the content of non-volatile matter in
sludge and increases the difficulty of degrada
When an excessive accumulation has
reached, sludge must be withdrawn for disp
Since the stabilization has been aerobic, howe
the stabilized sludge can be disposed of wit
serious troubles and unpleasant odors. (See
W71-04695) (Lowry-Texas)
W71-04698

**EFFECTS OF SLUDGE CONDITIONING W
LIME ON DEWATERING,**
Lurgi Gesellschaft fuer Chemotechnik m.b
Frankfurt am Main (West Germany).
H. Sontheimer.
Proceedings of the Third International Confere
on Water Pollution Research, Munich, Germ
1966, p 165-180. 11 fig, 2 tab, 11 ref.

Descriptors: *Lime, *Dewatering, *Centrifuga
*Neutralization, Filtration, Flocculation, Coag
tion, Sedimentation, Chemical precipitation,
kalinity, Hydrogen ion concentration, Waste w
treatment, Sludge, *Sludge treatment.
Identifiers: Lime bonding capacity, Lime addi
Vacuum filtration, Thickening, Reaction time.

A new sludge de-watering process, known as
Carbofloc process has been developed.
process is suitable for handling both fresh
digested mixed sludges, and has already been
cessfully applied on a commercial scale. Lim
added to the incoming sludge, and contributes
only the normal dehydrating effect of lime it
but also a lime bonding effect. Every sludge h
different lime-bonding capacity, and this cha
teristic is a major variable in lime addition slu
dewatering processes. After the lime addition,
its subsequent dehydrating effect, the mixtur
neutralized with CO2, the end result being the
version of free calcium hydroxide to insoluble
cium carbonate. When this neutralization is car
to the point where fixed calcium is converte
CaCO3, transcoagulation takes place, resultin
improved thickening properties and higher so
content during filtration and contrifuging.
higher the lime bonding capacity is the higher

crease in solids content will be. Therefore, the tal process involves compression of solids not parable on centrifuges by reaction with lime and 02 so that sedimentation with dewatering and mplete separation on decanting centrifuges is ssible. (See also W71-04700 thru W71-04702) owry-Texas)
71-04699

RMAL DISCUSSION OF 'EFFECTS OF UDGE CONDITIONING WITH LIME ON DE-ATERING',
hrverband, Essen (West Germany).
ich K. Moeller.
ceedings of the Third International Conference Water Pollution Research, Munich, Germany, 66, p 180-187. 5 fig, 2 tab, 5 ref.

scriptors: *Dewatering, *Calcium hydroxide, me, *Vacuum drying, Adsorption, Adhesion, illary water, Iron compounds, Colloids, Aera-, Flocculation, Coagulation, Activated sludge, vage, Waste water treatment.
ntifiers: *Metal hydroxides, Filter cake, Electro-ics.

ee basic types of sludge water have been dealt . In order of increasing difficulty of separation, are interspace water, adhesion and capillary er, and adsorption and internal water. Work is uired to overcome the liquid-solid binding es to dewater the sludge. The influence of ity is enough to remove interspace water, but hanical dewatering devices are needed to cope the other waters. Calcium hydroxide, when in the presence of metal salts or carbon diox- reduces the binding forces which hold the id to the solids. The effective range, however, is icted to the water binding. The overall in-igations did confirm the utility of lime as an ef-ve and economical aid in sludge dewatering. also W71-04699) (Lowry-Texas)
-04700

CUSSION OF 'EFFECTS OF SLUDGE CON-IONING WITH LIME ON DEWATERING',
yo Univ. (Japan).
iori Sugiki.
eedings of the Third International Conference Water Pollution Research, Munich, Germany, 5, p 188-192. 3 fig, 3 tab, 2 ref.

riptors: *Calcium carbonate, *Dewatering, cuum drying, Lime, Centrifugation, Sedimen-n, Coagulation, Flocculation, Sludge, Waste r treatment.
tifiers: *Sludge conditioning, Chemical condi-ng, *Elutriation, Specific resistance, Particle-listribution.

ge conditioning, to decrease the specific re-ce of filtration, depends upon factors such as cle shape, particle-size distribution, compres-y of sludge, and the ratio of organic solids and The three commonly used conditioning ods are addition of fine mineral solids, chemi-onditioning, and elutriation. Also, any com-ion of the three methods may be used together ovide better treatment. Coagulant require-s for sludge conditioning are composed of the e water requirement, and the sludge solid rement. Chemical reactions of the sludge with the coagulant may produce ammonium alcium carbonates. Calcium carbonate, also ed at times by CO2 addition is a problem in onded calcium carbonate builds up in the cake, and it will not dewater. (See also W71-9) (Lowry-Texas)
04701

USSION OF 'EFFECTS OF SLUDGE CON-ONING WITH LIME ON DEWATERING',
Hertfordshire Main Drainage Authority, answorth (England).
rd Wood.

Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 192-194. 1 tab.

Descriptors: *Lime, *Dewatering, Vacuum drying, Activated sludge, Sewage, Sludge disposal, Waste water treatment.
Identifiers: *Lime-bonding capacity, Flash-drying, Pressure filtration, Chlorinated copperas, Aluminum chlorohydrate, United Kingdom.

The two principle methods of dewatering in the United Kingdom today are pressure filtration with lime and copperas as sludge conditioners, and vacuum filtration using either chlorinated copperas or aluminum chlorohydrate. Lime has been applied only in situations where a metal filter medium is used. The variability of the activated sludge process itself prevents standard comparisons of pressure filtration versus vacuum filtration. Investigations have revealed, in agreement with other authors, that addition or iron salts after liming produces no change. Skepticism over the ability of lime and CO2 to further consolidate settled solids is expressed, much of the increased solids content being attributed to the lime bonding capacity and the amount of calcium carbonate precipitated. (See also W71-04699) (Lowry-Texas)
W71-04702

POPULATION DYNAMICS IN BIOLOGICAL TREATMENT PLANTS,
Water Pollution Research Lab., Stevenage (England).
A. L. Downing, and G. Knowles.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 117-136. 10 fig, 1 tab, 13 ref.

Descriptors: Kinetics, *Bacteria, *Protozoa, *Mathematical model, *Biodegradation, Metabolism, Acclimatization, Nitrification, Detergents, Aeration, Hydrogen ion concentration, Activated sludge, Water purification, Biological treatment, Microorganisms, Waste water treatment, Treatment facilities.
Identifiers: *Population dynamics, *Nitrosomonas, Anionic detergents.

Very little basic information is presently known about the relative numbers, activities, and nutritional requirements of the various types of microorganisms that can gain access to activated sludge plants. Predictions of removal of anionic detergents and degree of nitrification based upon population dynamics correspond very well with actual observed values. Mathematical models based on growth and decay rates are formulated to explain the rate of removal of certain substrates. Removal of a particular substrate from a waste water depends upon whether or not conditions existing in the treatment system are favorable for the growth of organisms capable of degrading the substance in question. The critical variables are temperature, pH, detention time, and whether or not any substances specifically toxic to the organism in question are present. Also, a certain acclimatization period may be required to establish the growth of a new organism. Hopefully, a more thorough knowledge of the growth patterns of the mixed microbial populations present in biological reactors will provide more insight into design conditions and procedures in the future. (See also W71-04704 thru W71-04706) (Lowry-Texas)
W71-04703

DISCUSSION OF 'POPULATION DYNAMICS IN BIOLOGICAL TREATMENT PLANTS',
Water Economics Research Inst., Warsaw (Poland).
Jerzy Ganczarcyk.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 136-173.

Descriptors: *Mathematical models, *Biodegradation, *Activated sludge, Detergents, Organic compounds, Nitrification, Biological treatment, Waste water treatment.
Identifiers: *Population dynamics, Intermediates, Enrichment, Over-aeration.

The work done by Downing and Knowles is supported, to a large extent, by work done in Poland by Ganczaryck, although several differences were noted. First of all, the sorption of certain substances on activated sludge flocs was selective and did not resemble closely the phenomenon of the Freundlich Isotherm. Also, the substances were often oxidized partially to form equally complicated intermediates, making determination of the biodegradable portion quite difficult. Secondly, the formulations could not explain fully the influence of physical factors on population dynamics, the interaction of activated sludge population in the degradation of some organics, or the limitation of one stage activated sludge processes in the elimination of some difficult organics. (See also W71-04703) (Lowry-Texas)
W71-04704

DISCUSSION OF 'POPULATION DYNAMICS IN BIOLOGICAL TREATMENT PLANTS',
Water Pollution Research Lab., Stevenage (England).
Ross E. McKinney.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 137-140. 3 tab.

Descriptors: *Bacteria, *Protozoa, *Metabolism, Microorganisms, Activated sludge, Detergents, Oxygen demand, Hydrogen ion concentration, Nutrients, Mixing, Oxygen, Temperature, Nitrification, Waste water treatment.
Identifiers: Mixed microbial populations, Pure culture, *Population dynamics, Waste retention time, Empirical, Microbial mass.

The parameters which are controlled by an engineer in an activated sludge plant are, waste retention time, pH, nutrient elements, mixing, oxygen, microbial mass, and temperature. All other elements are fixed by the nature of the waste and the metabolic rates of the microorganisms. Population dynamics should be approached from the fundamentals, rather than from complex empirical mathematics. A very carefully designed and controlled study of the combined bacterial and protozoan system is needed to provide engineers with a better fundamental understanding of population dynamics. (See also W71-04703) (Lowry-Texas)
W71-04705

DISCUSSION OF 'POPULATION DYNAMICS IN BIOLOGICAL TREATMENT PLANTS',
Indian Inst. of Science, Bangalore. Dept. of Biochemistry.
S. C. Pillai.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 140-141.

Descriptors: Microbiology, Biochemistry, Kinetics, Detergents, Nitrification, Protozoa, Bacteriology, Clarification, Activated sludge, Mathematical models, Waste water treatment.
Identifiers: *Population dynamics.

Numerous investigators have discovered that no matter what the origin of the waste being treated, the protozoan population remained constant. Protozoan activity may vary by species, but when taken as a whole the range of variation is so limited as to allow them to be considered a constant. Bacterial populations show no such specialization. Several features of the activated sludge process mechanics are: (1) it is rapid, (2) it removes both harmful impurities and bacteria, (3) successful operation depends upon maximum 'activity' being maintained by optimum aeration conditions, (4) it readily undergoes putrefactive changes in the absence of sufficient oxygen, (5) it increases

greatly in volume during purification. These are the essential features which a satisfactory explanation of the activated sludge process must cover. (See also W71-04703) (Lowry-Texas)
W71-04706

RELEASE OF SOLUBLE ORTHO-PHOSPHATE IN THE ACTIVATED SLUDGE PROCESS,
Kurita Central Labs., Yokohama (Japan).
Yasuhiro Sekikawa, Shozo Nishikawa, Minoru Okazaki, and Kenji Kato.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 261-276. 15 fig, 4 tab, 5 ref.

Descriptors: *Phosphorous compounds, *Activated sludge, *Microorganisms, Industrial wastes, Metabolism, Disinfection, Phenols, Poisons, Biochemical oxygen demand, Waste water treatment, Aerobic treatment, Sludge treatment, *Orthophosphorous compounds.
Identifiers: *Ortho-phosphates, *Aerobic digestion, Warburg respirator, Manometric apparatus, Sludge volume index, Volatile suspended solids, Mixed liquor, Aldehydes, Endogenous respiration.

During periods of unfavorable growth conditions, such as nutrient deficiency, low dissolved oxygen concentration, or the presence of toxic or inhibitory materials, activated sludge cultures will release orthophosphate back into solution. This conclusion, supported by the data presented in the figures and tables, suggests that phosphate variation might serve as an indicator of the physical condition of a biological treatment process. Measurement of phosphate concentration on a continuous basis will provide the plant operator with information as to how well the process is faring in regards to whether the microorganisms are working in as favorable an environment as possible. Further studies under more complicated operating conditions are a necessity in order to more fully understand the physical parameters of the system that are directly related to the change in phosphate concentration, and also those that are directly affected by the conditions which cause variations in the phosphate concentration. (See also W71-04708 and W71-04709) (Lowry-Texas)
W71-04707

DISCUSSION OF 'RELEASE OF SOLUBLE ORTHO-PHOSPHATE IN THE ACTIVATED SLUDGE PROCESS',
Illinois Univ., Urbana.
R. C. Engelbrecht.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 276-280. 1 tab, 16 ref.

Descriptors: *Orthophosphorous compounds, *Nitrogen, *Slimes, *Adsorption, Eutorphication, Dissolved oxygen, Aeration, Biochemical oxygen demand, Activated sludge, Waste water treatment.
Identifiers: Luxury uptake, Assimilation, Adenosine tri phosphate, Biosynthesis, Organic carbon, Protoplasm, Mixed liquor suspended solids, Orthophosphates.

The level of phosphorous in an activated sludge tank has been proposed as an indicator of the activity of the microorganisms in the system. Much variation in phosphorous uptake has been observed in various parts of the world. Phosphorous uptake in excess of normal requirements for biosynthesis is the subject of much debate. Luxury uptake, storage, synthesis of ATP, and adsorption onto the floc are a few of the mechanisms proposed to explain this excess uptake. Regardless of what mechanism causes the uptake, methods of continually monitoring the phosphorous content in the raw sewage, in the areation tank, and in the effluent are necessary before any application of phosphorous level as an indicator of biological treatment becomes practical. (See W71-04707) (Lowry-Texas)
W71-04708

DISCUSSION OF 'RELEASE OF SOLUBLE ORTHO-PHOSPHATE IN THE ACTIVATED SLUDGE PROCESS',
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).
Nils L. G. Westberg.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 281-283. 6 ref.

Descriptors: *Orthophosphorous compounds, *Iron compounds, *Eutrophication, *Dissolved oxygen, Aeration, Microorganisms, Metabolism, Nutrients, Biochemical oxygen demand, Activated sludge, Waste water treatment.

Sewage often contains considerable amounts of iron. This iron occurs mainly as iron hydroxide compounds which possess a high capacity of adsorbing phosphates. If considerable amounts of iron are intermittently present in the influent, the accuracy of the phosphorous level as an indicator of biological activity will be highly questionable. While no iron is present, the role of phosphorous as an indicator of biological activity has been well documented by several investigators. However, when considerable accuracy is necessary, this method falls short. Oxygen concentration has long been accepted as an indicator of biological activity, and with the advent of improved continuous dissolved oxygen monitors, it is doubtful that any other indicators should be preferred to dissolved oxygen level. (See also W71-04707) (Lowry-Texas)
W71-04709

THE INACTIVATION OF ENTEROVIRUSES IN SEWAGE BY CHLORINATION,
Technion - Israel Inst. of Tech., Haifa.
Hillel I. Shuval, Samuel Cymbalista, Alberto Wachs, Yitzhak Zohar, and Natan Goldblum.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, 1966, p 53-69. 4 fig, 12 ref.

Descriptors: *Viruses, *Coliform, *Vircide, *Chlorination, Waste water treatment, Sewage, Enteric bacteria.
Identifiers: Plaque forming units, Residual, Contact time, Hydroextraction, Haifa, *Poliovirus, *Echovirus, Inactivation, Israel.

The inactivation by chlorine of echovirus and poliovirus was compared with the inactivation of coliforms by chlorine in the Haifa, Israel sewage treatment plant. The pH ranged from 7.7 to 7.8, and the experiments were carried out at 20 plus or minus 2C. The chlorine formed complexes which are lower in disinfection ability than free chlorine. Chlorine residual was always above .3 milligrams per liter. Echovirus followed known inactivation patterns which were a function of time and chlorine concentration, being 99% inactivated after 30 minutes at 3.6 milligrams per liter of chlorine. Poliovirus was less sensitive with 50% and 90% reduction in 6 hours with 5 and 8 milligrams per liter respectively. The inactivation of echovirus was somewhat comparable to that of coliforms although the overall study indicated that coliform index in chlorinated sewage may not give a true picture. Inactivation of viruses seeded in sewage in concentrations many times greater than those normally present in sewage may not be representative of actual field situations. To carry out studies with normal wild virus concentrations, methods for detecting minimal virus concentrations as low as 1-10 plaque forming units, per liter are required. (See also W71-04711 and W71-04712) (Lowry-Texas)
W71-04710

DISCUSSION OF, 'THE INACTIVATION OF ENTEROVIRUSES IN SEWAGE BY CHLORINATION',
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Norman A. Clarke.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, p 44-46, 1966. 1 tab, 5 ref.

Descriptors: *Viruses, *Chlorination, *Disi
tion, Trickling filters, Coliform, Bacteria, Se
treatment, Waste water treatment.
Identifiers: *Enteroviruses, Inactivation, viruses, Echovirus 12, Coxsackie A9, streptococcus, Plaque counts, Hydro-extra
Chlorine residual.

Virus inactivation was monitored in primary ment facilities, trickling filters, activated sl and chlorine disinfecting units. It was found th tle or no virus inactivation occurred in pri treatment, and that the effluents from seco treatment facilities contained viruses as often the raw sewage. The trickling filter reduce levels somewhat, but still did not provide a r virus free effluent. The activated sludge unit vided 90% removal of poliovirus, and 98% re of Coxsackie A9 virus. Bacterial reductions much less subject to variation in these tests were viral reductions. Studies indicated tha mg/l concentration residual of chlorine during minute contact time would be sufficient to tivate viruses. Raw sewage chlorinated to lev .1 to .3 mg/l showed no reduction of active vi over non-chlorinated effluents. From this anal was evident that chlorination as it is now being dled is not sufficient to prevent viral growth. work is needed to provide methodology with to analyze viral concentrations in water san Also, residual chlorine measurements mus taken along with the samples in order to deter whether a virus is particularly virulent, or wh the chlorine has been reduced to a biological active level. (See also W71-04710). (Lowry as)
W71-04711

DISCUSSION OF 'THE INACTIVATION OF TEROVIRUSES IN SEWAGE BY CHLOR TION',
Vienna Univ. (Austria). Hygiene Inst.
G. Weber-Schutt.
Proceedings of the Third International Confe on Water Pollution Research, Munich, Germa 47-49, 1966. 1 fig, 1 tab, 1 ref.

Descriptors: *Viruses, *Bacteriophage, *Rad tivity techniques, Epidemiology, Pathogenic teria, Municipal wastes, Waste water treatmen
Identifiers: Staphylococcus phage 3C, Sodiu Poliomyelitis, Clarification, Emscher tank.

A municipal sewage treatment plant, having a sewage from a combined sewer as influent, consisting of an Emscher tank, trickling filter final settling tank, was seeded with staphyloco phage 3C. 15 minutes after the phage see radioactive sodium was added. Concentrati the phages was monitored at the outlets to the stages of the treatment plant, as was the lev radioactivity. The flow through curves were graphed and included in the report. 66% o phage particles passed through the plant and the receiving stream. This experiment was duplicated in a similar plant with similar re Although not all viruses behave in exactly the manner as the particular phage used, many do quite similarly. From these test results it was ous that plants of this type do not provide ade inactivation of viruses, and they must be redesi or replaced. (See also W71-04710). (Lowry as)
W71-04712

THE ROLE OF AERATION IN THE TIVATED SLUDGE PROCESS,
Hydraulic Research Inst., Prague zechoslovakia).
Vladimir Zahradka.
Proceedings of the Third International Confe on Water Pollution Research, Munich, Germa 53-69. 4 fig, 3 tab, 30 ref.

Descriptors: *Turbulence, *Mixing, Nutri Flocculation, Coagulation, Sedimentation, W purification, *Activated sludge, Sludge, Sl treatment, Waste water treatment, *Aeration.

lentifiers: Aerated space activity, Floc morpholo-
, Food to micro-organisms ratio, Mechanical
ppressor, Filamentous sludge, Oxidation rate.

he combination of factors known as the aeration
ace activity is the new basis for activated sludge
sign work. Activated sludge dry weight, where
e food to microorganism ratio does not approach
e state of non-flocculent growth is unable to
present the purification capacity of an activated
dge tank reactor. The aeration space activity can
determined by an experiment in which all
ocess parameters must be applied in full scale, in-
uding the mixing factor. In most cases, the mixing
ctor influences the aerated space activity to a
ch greater extent than does the sludge loading
ctor. As long as high oxygenation capacity is
quired, then the power requirements are not sig-
icantly different for the several types of aerators,
d consequently, the power requirement is not a
termining factor in the aeration system design.
ee also W71-04714 thru W71-04716). (Lowry-
xas)
71-04713

**RMAL DISCUSSION OF 'THE ROLE OF
RATION IN THE ACTIVATED SLUDGE
OCESS',**
partment of the Seine, Paris (France). Sanitary
rvices.
Feuillade.
oceedings of the Third International Conference
Water Pollution Research, Munich, Germany, p
72, 1966. 6 ref.

scriptors: *Aeration, *Oxygenation, *Turbu-
ce, Metabolism, Microorganism, Biodegrada-
n, Dissolved oxygen, Biochemical oxygen de-
nd, Activated sludge, Waste water treatment.
ntifiers: Respiratory activity, Oxygen capacity,
ecific intensity, Purification efficiencies, Sludge
ıor, Beckman electrode, Zarhadaka, Paris,
nce.

spite much research on the subject, the
ponents of small bubble aeration are still in dis-
eement with the proponents of large bubble
ation as to which bubble size is actually optimal
activated sludge. Experiments conducted at the
ification Plants of the City of Paris, the Depart-
nt of the Seine, the Experimental Center at
ombes, and the Purification Plant of Acheres
port the coarse or medium bubble system as
viding the greatest overall benefit for the ac-
ted sludge system. The differences in aeration
ciencies between large and small bubbles
ome smaller as the oxygenation capacity
omes larger. Also, larger bubbles break up the
wth patterns of filamentous organisms, while at
same time providing the best use of the aeration
ver for flocculating the sludge blanket and set-
g organic substances on the sludge. The
kman electrode was used to obtain values of
olved oxygen present in a sample of activated
ge. This equipment is correct only within 10%,
the most economical design will not be possible
l oxygen levels at all points in the tank at all
es can be continuously monitored. (See also
1-04713). (Lowry-Texas)
1-04714

**CUSSION OF 'THE ROLE OF AERATION IN
E ACTIVATED SLUDGE PROCESS',**
rverband, Essen (West Germany).
Rincke.
ceedings of the Third International Conference
Water Pollution Research, Munich, Germany, p
78. 4 fig, 13 ref.

criptors: *Submergence, *Boundary layers,
ot plants, Aeration, Turbulence, Activated
ge, Waste water treatment.
ntifiers: Contact frequency, Specific surface,
nminution, Specific aeration intensity, Mixing
, Sludge loading, Oxygen transfer.

Turbulence activates the biological processes according to work done at the Ruhrverband in Germany over the past several years. Oxygen uptake is a function of the frequency of contact which increases in proportion to the velocity gradient. Increased velocity gradient G, provides increased shear forces proportional to G to the 2nd power. These shear forces mechanically comminute the floc, giving it a larger specific surface for the biological activities. Sludge loading, then, expressed in Kg BOD5/day/Kg dry solids can be used only as an auxiliary term. Experiments also showed that bubbles flowing into an aeration tank were subjected to too many unknown or incalculable influences to follow a strict mathematical derivation. The geometric conditions of an aeration tank were proven to be of considerable significance, especially for the judgement of experimental results. Oxygen transfer experiments showed medium bubble aeration to achieve nearly the same transfer rate under similar conditions as fine bubble aeration. (See also W71-04713). (Lowry-Texas)
W71-04715

DISCUSSION OF 'THE ROLE OF AERATION IN THE ACTIVATED SLUDGE PROCESS',
Technische Hochschule, Vienna (Austria).
Wilhelm Von Der Emde.
Proceedings of the Third International Conference on Water Pollution Research, Munich, Germany, p 79-81, 1966.

Descriptors: *Oxygenation, *Turbulence, Mixing, Aeration, Biochemical oxygen demand, Activated sludge, Waste water treatment.
Identifiers: Specific aeration intensity, Immersion depth, Inka-aeration, Bubble-aeration.

The 'specific aeration intensity', introduced by Zahradka allows several different aeration devices with different immersion depths to be easily compared. While it is possible to get better oxygenation efficiencies at higher aeration intensities, this is not always the case. To achieve an effluent quality of 25 mg/l BOD5, the oxygenation capacity should range from 2-3 Kg O2/day/cubic meter, and 3-5 Kg O2/day/cubic meter for partial treatment. Table I shows average values obtained from a series of tests at Hamburg 1964-1965. At present, there is no common denominator for comparison of wideband and furrow aeration with surface aerators. The energy input related to one cubic meter of aeration tank for one hour is proposed as such a yardstick. Turbulence should be considered as a factor along with but not totally in place of aeration time and sludge loading factors. While turbulence is a significant factor, it is of no greater importance than the conventionally accepted parameters. (See also W71-04713). (Lowry-Texas)
W71-04716

PLANNING COOLING WATER FOR POWER STATIONS,
Central Electricity Generating Board, London (England). Station Planning Board.
K. M. Gammon.
Advances in Water Pollution Research, Fourth International Conference on Water Pollution Research, Prague, Czechoslavakia, p 927-936, April 21-25, 1969. 4 fig, 3 tab, 6 ref.

Descriptors: *Cooling water, *Cooling towers, *Power stations, *Thermal pollution, Cooling, Heated water, Evaporation.
Identifiers: *Great Britain, *Thames, Salt scaling, Purge discharge.

Water is required to make up evaporation and purge. The amount of purge is related to the nature of the source and to the treatment given. Analysis on inland wet tower cooled stations abstracting fresh water and discharging to rivers, and direct cooled stations on tidal waters taking and returning much greater volumes of brackish or salt water are presented in this paper. Chemical changes in water used for cooling and complex. Investigations show purge discharges to be well aerated with more concentrated salts in solutions and some heat added. With cooling towers heat is lost to the atmosphere by evaporating about 1% of the water circulated in the cooling water system. Salts in solution are progressively concentrated by this evaporation and will eventually lead to deposition of scale. Scaling on the river surface of condenser tubes reduces heat transfer rates, and its control is an important aspect in operation. It is stated that purge discharges can be integrated with benefit into river management schemes. Heat is the main addition to cooling water discharges. This can have both immediate and long-term effects. Care is taken to avoid rapid successive reheating of water for operational and environmental reasons. (Herrera-Vanderbilt)
W71-04724

EFFECTS OF AXIAL DISPERSION ON THE OPTIMAL DESIGN OF THE ACTIVATED SLUDGE PROCESS,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
L. T. Fan, G. K. C. Chen, L. E. Erickson, and M. Naito.
Water Research, Vol 3, No 4, p 271-284, April 1970. 14 p, 7 fig, 19 ref.

Descriptors: *Optimization, *Activated sludge, *Aeration, *Mathematical models, Costs, Organic wastes.
Identifiers: *Axial dispersion, Pattern search technique.

The axial dispersion (longitudinal mixing) which occurs in the aeration chamber of the activated sludge system was investigated to determine the effects of axial dispersion on system performance. A so-called diffusion model was employed to characterize the flow in the aeration chamber. A pattern search technique in conjunction with the quasilinearization technique for solving the split boundary value problem of the nonlinear differential equation was used to determine the optimum design of the system. Two economic models, the overall size (total volume) of the aeration chamber and clarifier, and the total construction cost based on Smith's correlation for unit costs of subunits of the activated sludge process, were optimized and the results were compared. This analysis showed that the Peclet number, which indicated the extent of longitudinal fluid mixing or dispersion in the aeration chamber, and the feed concentration of organic sewage are two important parameters which affect optimum design of activated sludge systems. Longitudinal mixing appeared undesirable, especially when the feed concentration of organic sewage was large. (Kriss-Cornell)
W71-04768

DIGITAL COMPUTER SIMULATION OF WASTE TREATMENT PLANTS USING THE WATCRAP-PACER SYSTEM,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 07C.
W71-04772

MATHEMATICAL MODEL FOR WATER-WASTE WATER SYSTEMS,
Bechtel Corp., San Francisco, Calif. Scientific Development Dept.
Clark L. Weddle, S. K. Mukherjee, J. W. Porter, and H. P. Skarheim.
Journal American Water Works Association, Volume 62, No 12, p 769-775, December 1970. 7 p, 8 fig, 2 tab, 6 ref.

Descriptors: *Optimization, *Network design, *Mathematical models, *Waste water treatment, *Water demand, *Costs, Linear programming, Municipal water, Waste water disposal, Water supply.
Identifiers: Least-cost analysis, Out-of-kilter algorithm.

A network analysis-based model for selecting the least-cost water supply and waste water disposal system for a municipal area was developed. The basic elements considered included treatment of conventional water, seawater, and waste water, and storage and conveyance requirements. Lines or 'arcs' were assigned for each function or activity and each end of every arc was given a designation, termed a 'node'. A closed loop cycle was established by interconnecting all sources with all demands. For each arc used, a unit cost was assigned to the flow. The general purpose network program, based on an integer-linear programming method, used an out-of-kilter algorithm. To account for nonlinear cost functions and to formulate the input data correctly an iteration process was developed which used a preprocessing program and a recosting program. Model use included development of: the network, quality criteria and treatment requirements, cost information, least cost solution, and reiteration. The effects of blending conventional water sources with distilled seawater were considered. The example problem involved two municipal water demands, one industrial cooling water demand, one industrial process water demand, and one agricultural irrigation demand, and water supplies from two conventional water treatment plants and one seawater distillation plant. Input data and example solutions were given. (Kriss-Cornell)
W71-04774

WATER REUSE SYSTEMS ANALYSIS,
Institute for Water Resources (Army), Alexandria, Va.; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
A. Bruce Bishop, and David W. Hendricks.
Journal of the Sanitary Engineering Division, ASCE, Vol 97, No SA1, p 41-57, February 1971. 17 p, 3 fig, 9 tab, 10 ref, 2 append.

Descriptors: *Systems analysis, *Optimization, *Water reuse, *Costs, Transportation, Waste water treatment, Tertiary treatment, Desalination, Linear programming, Water demand, Utah.
Identifiers: *Origin-destination matrix, Salt Lake City.

A systems approach for analyzing water reuse alternatives was developed for sequential and recycle water reuse which delineated optimal allocations from each supply category to each use sector of an origin-destination matrix for minimization of costs. Three levels of treatment were included: (1) conventional primary-secondary; (2) tertiary; and (3) desalting. A classical transportation algorithm, using linear programming was adapted to include unit cost of delivering water having a specified quality from each origin to each destination. Treatment cost, as well as the transport cost, was included. A case study of the agro-urban-industrial region of the Salt Lake City area demonstrated an application of the model to a specific metropolitan area. Least cost results for levels of demand for the years 1965, 1980, 2000, and 2020 showed a changing pattern of allocation. The model showed that for 1965, surface and groundwater supplies were sent directly to user destinations, with effluents to system outflow; by 1980 tertiary treatment enters the picture; and by 2020 desalting, and surface and groundwater blending with output from tertiary treatment and desalting plants becomes important. (Kriss-Cornell)
W71-04778

ECOLOGY OF FOULING ORGANISMS IN A POLLUTED AREA,
Democritus Nuclear Research Center, Athens (Greece). Hydrobiology Group.
Lydia Ignatiades, and Th. Becacos-Kontos.
Nature, Vol 225, No 5229, p 293-294, January 17, 1970. 1 fig, 6 ref.

Descriptors: Water pollution effects, Ecology, *Microorganisms, *Fouling, *Growth rates, *Settlement, Lethal limit, Oily water, Oil wastes, Harbors.
Identifiers: Toxic tolerance, *Oil pollution, Oil spillage, Athens, Greece, Harbor pollution.

Fouling organisms were studied in an oil polluted area of Pireus Port, near Athens, Greece. Growth and settlement rates were observed, using wooden test blocks for settlement. Poor light conditions due to suspended mud seemed to favor attachment and the organisms successfully tolerated the toxicity of the polluted water. (Ensign-PAI)
W71-04798

PUBLIC WATER SUPPLY AND SEWER SYSTEM (FINANCIAL SUPPORT FOR MUNICIPAL SEWAGE TREATMENT WORKS).
For primary bibliographic entry see Field 06E.
W71-04843

KINETICS OF AEROBIC UTILIZATION OF MIXED SUGARS BY HETEROGENEOUS MICROBIAL POPULATIONS,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
Sambhunath Ghosh.
Environmental Resources Center, Georgia Institute of Technology, WRC-0969, November 1969. 467 p, 73 fig, 18 tab, 411 ref. FWPCA Training Grant 5T1-WP-62-03--05.

Descriptors: *Biological treatment processes, *Waste water treatment, *Microorganism growth kinetics, *Aerobic conditions, *Water quality control, Cellular metabolism, Biomass synthesis, Amino acids, Nutrient transport.
Identifiers: *Glucose, *Galactose, *Monod growth kinetic model.

The objectives of the research was to delineate the roles of biochemical, physiological and physical factors in the causation of phasic uptake of organic nutrients in waste stabilization systems and to formulate basic kinetic models for predicting biomass production and the uptake rates of component substrates from mixtures. The research was performed in a chemostat type reactor using influents which contained glucose and galactose as the competing substrates. Results of continuous culture studies using heterogeneous aerobic cultures showed that the rates of biomass production and of assimilation of individual substrates were controlled by that substrate which allowed the highest growth yield and permitted the maximum specific growth rate when presented as the sole carbon and energy source. Changes in dilution rates induced concomitant changes in the physiological character of the dominant reactor population, and this phenomenon played an important role in causing concurrent assimilation of competing substrates in completely mixed continuous flow processes. In batch or plug flow reactors the utilization pattern may be concurrent or sequential depending on the physiologic character of the seed population employed and the initial concentration ratio of substrates. Equations were presented for describing the courses of eliminations of component substrates and biomass production in completely mixed or continuous flow processes. (Conway-Georgia Tech)
W71-04848

5E. Ultimate Disposal of Wastes

COLLECTION AND DISPOSAL OF FARM WASTES,
Ministry of Agriculture (Northern Ireland).
For primary bibliographic entry see Field 05D.
W71-04486

EFFECTS OF MARINE SEWAGE DISPOSAL,
Water Pollution Research Lab., Stevenage (England).
E. B. Pike, and A. L. H. Gameson.
Water Pollution Control, Vol 69, No 4, p 355-382, 1970. 149 ref.

Descriptors: *Public health, *Disea
*Epidemiology, Recreation, Water quality, W
pollution, Ecology, Aesthetics, Fish, Bacte
Shellfish, Standards, Waste water treatm
*Sewage disposal, Water pollution effects.
Identifiers: *Medical aspects.

The main objections to the discharge of untrea
sewage to the sea are raised on aesthetic and m
cal grounds. Aesthetic objections are often
founded and can be overcome by suitable scre
ing or disintegration of the sewage bef
discharge. The medical problems arising out
marine discharge are quite insignificant and the
jections and standards are based primarily on
possibility rather than the probability of contac
enteric disease. There appears to be no need f
standard based epidemiological evidence as a s
dard based on aesthetics would suffice. Howe
shell-fisheries have special needs for unpollu
waters for public health reasons and because t
ecology is easily damaged. An open discussion
delegates is included. (Ellis-Texas)
W71-04491

**TREATMENT OF PHOTOGRAPHIC LABO
TORY WASTES AT NORTON AIR FOR
BASE, CALIFORNIA,**
Montgomery Research, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 05D.
W71-04500

**POSSIBLE TOXIC EFFECTS OF CYANAT
THIOCYNATES, FERRICYANIDES, FERR
CYANIDES AND CHROMATES DISCHARG
TO SURFACE WATER,**
Montgomery Research Inc., Pasadena, Calif.
For primary bibliographic entry see Field 05C.
W71-04501

**DISPOSAL OF BRINES PRODUCED
RENOVATION OF MUNICIPAL WAS
WATER.**
Burns and Roe, Inc., Oradell, N.J.

Copy available from GPO Sup Doc
I67.13/4:17070DLY, $1.25; microfiche from NT
as PB-197 597, $0.95. Water Pollution Cont
Research Series ORD-17070 DLY 05/70, M
1970. 113 p, 16 tab, 25 fig, 33 ref, append. FWQ
Program No 17070 DLY.

Descriptors: *Ultimate disposal, *Brine dispos
Municipal wastes, Deep wells, Injection we
Evaporation, Brines, *Disposal, Costs, Effluen
*Waste water disposal, Waste water treatme
Texas, Arizona, Colorado.
Identifiers: Brine wastes, *Municipal waste wat
Waste water renovation, El Paso (Tex), Tucs
(Ariz), Denver (Colo), Deep well injection, *So
evaporation, Brine reduction, Multistage fla
evaporation.

Costs of ultimate disposal of brine wastes from m
nicipal water renovation schemes have been
vestigated for the sites of El Paso, Texas Tucso
Arizona and Denver, Colorado. Based on 10 m
lion gallons per day, 7% fixed charge rate, and
mills/Kwhr power cost, estimated costs are as f
lows: Near El Paso, Texas, brine can be dumped
worthless arid land at a cost of $.052/Kgal. It c
be injected into the saline Hueco-Bolson Basin
$0.13/Kgal. Solar evaporation in local ponds, usi
30 mil liners and a pipeline to convey residual bri
50 miles for ultimate disposal, costs $0.18 Kg
Solar evaporation east of Denver, using ponds wi
a 30 mil liner, would cost $0.76/Kgal. Alternate
solar evaporation east of Pueblo, Colorado in lin
ponds would cost $0.96/Kgal., including t
pipeline from Denver. Multistage flash evaporati
to 10% solids would reduce the amount of bri
and the size of the solar ponds to a point where th
might be acceptable. Their combined cost, bas
on $0.46/mbtu steam and steam-driven pumps
$0.54/KGAL. of brine effluent. Well injection
unfeasible here, due to earthquakes. At Tucso
the temporary measure of using injection wells

500 feet while awaiting the Southwest Water Plan ould cost $0.13/Kgal. A permanent scheme, using cal solar ponds with 30 mil liners would cost 0.18/Kgal., including costs for a residual brine peline to the Wilcox Plaza 50 miles eastward.
71-04614

HARACTERIZATION, TREATMENT, AND ISPOSAL OF URBAN STORMWATER,
bert A. Taft Sanitary Engineering Center, Cinnati, Ohio.
r primary bibliographic entry see Field 05D.
71-04687

IL ENRICHMENT EXPRESS,
rps of Engineers, Washington, D.C.
rren J. Papin.
ter Spectrum, Army Corps of Engineers, p 16-, Winter 1970.

scriptors: *Ecology, Operations research, udge disposal, *Municipal wastes, *Sewage dge, Soil management, Environmental engineer-.
ntifiers: *Environmental problems, Water ources planning.

e pressing environmental problem today is the wing volume of sludge which is extracted from constant flow of sewage. The common solution flush it down a convenient river or into a lake. Metropolitan Sanitary District of Greater cago, however, has found a beneficial solution; are shipping it out to area farmers for use as ilizer. Most nations use human wastes as fertil-, but without treatment wastes can be dan-ous to health. The Soil Enrichment Materials poration of Chicago (SEMCO) leaves the ge in a semiliquid form (slurry) is pumped into ling lagoons then to railroad tank cars where it nen transported to farm lands. In tests con-ted last year in conjunction with the University linois and the US Department of Agriculture, lts proved that sludge can produce excellent s. The fertility of sludge is in organic form, viding for slow release over a long period of . As such, it is much less susceptible to loss by hing and runoff than inorganic fertilizers. ge has been used to rejuvenate sterilized nd and sand filled areas. (Wray-Chicago)
-04751

TOM FAUNA IN A SEA AREA THWEST OF HELGOLAND, SELECTED INDUSTRIAL WASTE DISPOSAL, (IN MAN),
primary bibliographic entry see Field 05C.
-04828

Water Treatment and Quality Alteration

-ECONOMIC FACTORS RELATED TO INCIDENCE OF WATER-BORNE DIS-E,
o Rico Univ., Mayaguez. Water Resources arch Inst.
ge C. Uzdavinis.
able from NTIS as PB-197 674, $3.00 in copy, $0.95 in microfiche. Technical letion Report, Nov. 1970. 49 p, 2 ref, 16 tab, OWRR Project A-018-PR (1).

riptors: *Water pollution effects, Soil con-ation effects, Economic impact, Income, ic health, Social impact, *Social aspects, to Rico.
fiers: *San German (PR), Gastroenteritis, o Nuevo, El Recreo.

tempt was made to determine whether socio-mic factors were related to the incidence of ater-borne disease gastroenteritis in two hous-reas within the town of San German in southwestern Puerto Rico. By the use of a questionnaire survey made in a substandard housing area and one made in a housing project, the author elicited income and education level information from the inhabitants. Socio-economic data were compared with the number of cases of the disease treated at the public health center from each area. The results were inconclusive. (Holmes-Rutgers)
W71-04675

AMENDED 1964 MASTER PLAN OF WATERWORKS IMPROVEMENTS FOR BOARD OF WATERWORKS COMMISSIONERS, MADISON, WISCONSIN, 1969 REVISION.
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 08A.
W71-04678

LINEAR PROGRAMMING APPLIED TO MULTI-STAGE CAPACITY EXPANSION OF WATER TREATMENT-DISTRIBUTION SYSTEM,
Illinois Univ., Urbana. Dept. of Business Administration.
Hirohide Hinomoto.
A paper presented at the 38th National ORSA Meeting, October 28, 1970. 32 p, 3 fig, 3 tab, 17 ref.

Descriptors: *Water supply, *Water requirements, *Water demand, *Water distribution, *Municipal water, *Linear programming, Capital costs, Operating costs, Illinois, Mathematical models, Water treatment, Distribution systems, Treatment facilities.
Identifiers: *Facilities expansion.

An optimal plan was developed for expanding the capacity of municipal water treatment-distribution systems. Linear programming is applied to the multi-stage capacity expansion of a municipal water treatment-distribution system in order to determine the required sizes of new treatment plants and distribution reservoirs and the times at which they should be added to the system. The capital and operating costs of each type of facility are represented by exponential functions in concave form showing economies of scale available with an increase in capacity. Linear functions in polygonal form approximate each nonlinear cost function, thereby transforming the original nonlinear formulation to a linear program. For illustration, the linear program formulated is applied to the water supply system serving the twin city of Champaign-Urbana, Illinois, and its vicinity under assumed conditions approximating the real situations. The system obtains water from practically unlimited under-ground sources. Finally, the usefulness of the model depends much on the availability of reliable information on future demands and the capital and operating cost functions related to the types of facilities considered. Since most cost data available in published studies are not useful for the present model, the collection of reliable current data for determining cost functions usually is prerequisite to the successful application of this model. (Poertner)
W71-04737

5G. Water Quality Control

VESSEL POLLUTION CONTROL.
Federal Water Quality Administration, Edison, N.J. Water Quality Lab.

Federal Water Quality Administration, Edison Water Quality Lab Research Newsletter, Vol 1, December 1970. 12 p.

Descriptors: *Recreation wastes, *Water pollution sources, *Boating, *Water pollution control, Sewage, Waste water (Pollution), Projects, Sanitary engineering.
Identifiers: *Boating wastes, Outboard motor wastes.

This report describes on-going and completed FWQA research development and demonstration projects for controlling waste pollution from watercraft, outlines the problem of pollution from outboard motors, discusses water quality standards for vessels; and details proposed research and development needs for controlling vessel pollution. This can be accomplished through grants, contracts, and in-house efforts. The many watercraft of all classes which use American waters are capable of utilizing the water resources in any of our 50 states and can deposit varying amounts of wastes at any location causing localized pollution. It is estimated that the total daily waste discharged from all watercraft approximates the wastes from a city of one-half million people. (Knapp-USGS)
W71-04363

MAP SHOWING AREAS SERVICED BY MUNICIPAL AND PRIVATE SEWERAGE AGENCIES, SAN FRANCISCO BAY REGION, 1970,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-04367

DETERMINING SEEPAGE CHARACTERISTICS OF MILL-TAILINGS DAMS BY THE FINITE-ELEMENT METHOD,
Bureau of Mines, Spokane, Wash. Mining Research Lab.
For primary bibliographic entry see Field 08D.
W71-04425

COOLING TOWER APPLICATION,
Kohloss (Frederick H.) and Associates Inc., Honolulu, Hawaii.
For primary bibliographic entry see Field 05D.
W71-04442

TEMPERATURE VARIATIONS IN DEEP RESERVOIRS,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
Yu-Leuk Choi.
Journal of the Hydraulics Division, Proceedings of the ASCE, Vol 96, No HY10, p 2154-2158, October 1970. 1 fig, 1 ref.

Descriptors: Reservoirs, Thermal stratification, Model studies, Temperature.
Identifiers: *Temperature variations, Effective diffusivity.

The essential features of the model described are the methods used to allow for advection and convective mixing at the water surface. It is assumed that density is a monotone decreasing function of temperature in the range considered. Some assumptions are used, such are: all horizontal planes are isotherms within the region of water impoundment, inflow enters the system at the elevation where the resident water has the same temperature; outflow rate at any elevation is equal to the withdrawal rate at that elevation. Both inflow and outflow are algebraically additive in the upward vertical direction. These specify the pattern of total vertical flow in the reservoir. These also complete the one-dimensionality of the system and leads to the simplification that temperature distribution is describable by considering only the conservation of mass and heat energy. (Herrera-Vanderbilt)
W71-04446

ECONOMIC AND ADMINISTRATIVE PROBLEMS OF WATER POLLUTION,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 06B.
W71-04450

ECONOMIC GROWTH AND ENVIRONMENTAL COSTS,
Coe Coll., Cedar Rapids, Iowa.
For primary bibliographic entry see Field 06B.
W71-04451

TECHNOLOGICAL INJURY,
Blackburn Coll. of Technology and Design (England).
For primary bibliographic entry see Field 06G.
W71-04465

WATER POLLUTION,
Mersey and Weaver River Authority (England).
For primary bibliographic entry see Field 06B.
W71-04466

LABORATORY STREAM STUDIES OF A BENTHIC COMMUNITY,
Missouri Univ., Columbia. Dept. of Sanitary Engineering.
Gale Allen Wright.
MS thesis, 1970. 70 p, 32 fig, 27 ref, append. OWRR Project A-011-MO (2).

Descriptors: *Self-purification, *Algae, *Streams, Laboratory tests, Dissolved oxygen, Hydrogen ion concentration, Alkalinity, Respiration, Photosynthesis, Carbon dioxide, Primary productivity, Biodegradation, Organic matter, Oxygen, Chemical oxygen demand, Benthos.
Identifiers: *Oxygen balance.

The aim of this study was to determine the role of algae in biodegradation of organic wastes and self-purification of streams. The monitoring of the system in a laboratory stream microcosm was accomplished by determination of dissolved oxygen, pH, and bicarbonate-carbonate alkalinity. The results indicated a lesser constancy of production process in comparison with that of respiration. The carbon:oxygen ratio was influenced by the age of algal cells. The oxidation of organic substances occurred during periods of darkness. Photosynthetic production was limited by the available carbon dioxide. The contribution of algae to selfpurification of water appeared to be very low. The determination of photosynthetically produced oxygen could not be reliably accomplished before the synthesized material had been oxidized. (Wilde-Wisconsin)
W71-04518

EFFECT OF ENVIRONMENTAL FACTORS ON BENTHAL OXYGEN DEMAND,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
S. Douglas Hall.
MS thesis, 1966. 60 p, 11 fig, 5 tab, 25 ref, append. OWRR Project A-003-PA (1).

Descriptors: *Benthos, *Decomposing organic matter, *Streams, *Bottom sediments, Aerobic conditions, Anaerobic conditions, Oxygen demand, Respiration, Mathematical studies.
Identifiers: Oxygen concentration, Slab Cabin Run (Pa).

Benthal aerobic-anaerobic decomposition in the ecto- endo-zones of bottom sediments are described. The study was conducted in a laboratory reaction chamber using benthos samples collected from a small stream. A decrease in oxygen concentration of supernatant water was paralleled by a lower rate of oxygen demand of benthal material, although the latter slightly increased with the depth of the benthos. The rate of oxygen concentration and utilization was controlled by the invertebrate:bacteria respiration ratio. The respiration of macroinvertebrates accounted for 40 to 60% of the total OD. The total respiration of the benthal layer investigated was expressed by an empirical equation incorporating bacterial respiration, the number of invertebrates, and oxygen concentration at 20C. (Wilde-Wisconsin)
W71-04519

A REVIEW OF HERBIVOROUS FISH FOR WEED CONTROL,
Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga. Southeastern Fish Control Lab.
Joe B. Sills.
The Progressive Fish-Culturist, Vol 32, No 3, p 158-161, 1970. 12 ref.

Descriptors: *Fish, *Herbivores, *Aquatic weed control, Tilapia, Carp, Algae, Rooted aquatic plants, Plankton, Arkansas, Insects, Turbidity, Chara, Pondweeds.
Identifiers: Tilapia nilotica, Tilapia mossambica, Tilapia melanopleura, Cyprinus carpio, Ctenopharyngodon idellus.

There is growing interest in biological pest control as a substitute for pesticides. Fish receiving most attention for aquatic weed control possibilities are Tilapia nilotica, T mossambica, and T melanopleura; the Israeli strain of carp (Cyprinus carpio); and the Chinese or grass carp (Ctenopharyngodon idellus). Results obtained with each are reviewed. All tests in which Tilapia were stocked in ponds resulted in overcrowded populations and unsatisfactory weed control. Although the carp is effective in reducing or controlling aquatic plants, detrimental aspects of its presence make its usage undesirable in recreation and fishing waters. Tests showed that the Israeli strain is not primarily herbivorous, but roots in the bottom much as wild carp do. Observations are continued to learn why the Israeli strain does not reproduce in ponds with mixed populations. All observations to date on the grass carp are most favorable. It does feed on aquatic vegetation. There is no indication of natural reproduction, but the fish can be spawned. As its native habitat is similar to some of our large river systems, the grass carp may adapt to them. More information is needed for its use except in strictly controlled environments. (Jones-Wisconsin)
W71-04528

THE FOREST AS A STOREHOUSE OF CITY WATER, (IN GERMAN),
Vienna (Austria).
For primary bibliographic entry see Field 03B.
W71-04535

FEASIBILITY STUDY MANUAL - MINE WATER POLLUTION CONTROL DEMONSTRATIONS.
NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

For sale by Superintendent of Documents U.S. Government Printing Office, Wash, D.C. 20402, I67.13/4:14010FLW $0.65. Microfiche from NTIS as PB-197 594, $0.95. Water Pollution Control Research Series 14010 FLW 07/70, June 1970. 65 p, 2 fig, 3 ref, 4 append. FWQA Program 14010 FLW.

Descriptors: *Acid mine water, *Water pollution control, *Feasibility, *Project feasibility, *Feasibility studies, Project planning, Federal project policy, Optimum development plans, Programs, Project purposes, Water pollution treatment, Abatement.
Identifiers: *Mine drainage abatement.

This manual is to be used as a guide by State or interstate agencies in uniformly performing feasibility studies for projects proposed to demonstrate methods for the abatement of mine drainage pollution as required by Section 14 of the Federal Water Pollution Control Act as amended. The required feasibility studies are to aid the Secretary of the Interior in selecting the mine drainage pollution control method or methods suitable for demonstration, and also the optimum watershed where the effectiveness of the project will have the greatest public value or uses. (Knapp-USGS)
W71-04545

COLLECTED PAPERS REGARDING NITRATES IN AGRICULTURAL WASTE WATERS.
Federal Water Quality Administration, San Francisco, Calif.
For primary bibliographic entry see Field 05B.
W71-04546

GENESIS AND SCOPE OF INTERAGEN COOPERATIVE STUDIES OF CONTROL NITRATES IN SUBSURFACE AGRICULTUR WASTE WATERS,
Bureau of Reclamation, Sacramento, Calif.
Edgar P. Price.
In: Collected Papers Regarding Nitrates in Agric tural Waste Waters, Federal Water Quality ministration Water Pollution Control Research ries 13030ELY 12/69, p 1-14, December 1969. p, 2 fig, 2 tab, 8 ref. FWQA Project 13030ELY.

Descriptors: *Water pollution sources, *Ret flow, *Nitrates, *Water pollution control, *Calif nia, Drainage engineering, Drainage effects, Irri tion programs, Irrigation systems, Water mana ment (Applied), Eutrophication, Path of po tants, Groundwater, Irrigation effects, Drain water, Water quality, Excess water (Soils), Ret flow, Drainage programs.
Identifiers: *San Luis Drain (Calif), *San Joaq Master Drain (Calif), *Central Valley (Calif).

The programs of the United States and the State California to build San Luis Drain and San Joaq Valley master drain, and the concern for wa quality in San Francisco Bay prompted a coope tive investigation of methods for removing nitra from subsurface agricultural waste water. The vestigation broadened to include examination the source of the nitrates and the changes in nitr form which might occur spontaneously or wh might be induced as the subsurface water is lected and conveyed through California's Joaquin Valley to the head of the San Franci Bay System. The results of the investigation very briefly reviewed and presented in summary bles. (See also W71-04546) (Knapp-USGS)
W71-04547

PREDICTING CHANGES IN NITROGENO COMPOUNDS IN SOIL-WATER SYSTEMS,
Arizona Univ., Tucson.
Marvin J. Shaffer, Gordon R. Dutt, and William Moore.
In: Collected Papers Regarding Nitrates in Agric tural Waste Waters, Federal Water Quality ministration Water Pollution Control Research ries 13030ELY 12/69, p 15-28, December 19 14 p, 7 fig, 4 tab, 9 ref. FWQA Project No 1303 LY; Bur Reclam. Contract No 10-06-D-6464.

Descriptors: *Simulation analysis, *Path of po tants, *Return flow, *Nitrates, Mathemati models, Computer programs, California, Wa pollution sources, Leaching, Drainage water, A monia, Drainage effects, Groundwater, Wa quality, Soil water.
Identifiers: *Groundwater pollution, *Central V ley (Calif).

A digital computer program was developed model soil-water systems with respect to nitro transformations, including hydrolysis of urea, mobilization-mineralization of ammonia and ganic nitrogen, and immobilization of nitr nitrogen. Comparisons were made of predicted observed data for several soils having different t tures and various moisture contents, temperatu and fertilizer applications. This procedure yiel simple correlation coefficients of 0.99, 0.97, 0.97 for the urea, organic, and ammo nitrogenous types. A model predicting the conc trations of nitrogenous species occurring in s water systems aids in planning management crite for pollution control and fertilizer programs. (also W71-04546) (Knapp-USGS)
W71-04548

COMBINED NUTRIENT REMOVAL A TRANSPORT SYSTEM FOR TILE DRAINA FROM THE SAN JOAQUIN VALLEY,
California State Dept. of Water Resources, Fres and Federal Water Quality Administration, Fres Calif.; and California Univ., Berkeley. Dept. Sanitary Engineering and Public Health.
For primary bibliographic entry see Field 05D.
W71-04557

WHERE IS URBAN HYDROLOGY PRACTICE TODAY,
Department of Housing and Urban Development, Washington, D.C.
For primary bibliographic entry see Field 04C.
W71-04572

HYDRAULIC PROPERTIES RELATED TO STREAM REAERATION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
C. C. Tsivoglou, and J. R. Wallace.
Research supported by grant from Federal Water Quality Admin. In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/31, p 509-522, 1970. 14 p, 2 fig, 2 tab, 8 ref.

Descriptors: *Reaeration, *Mixing, *Turbulent flow, *Tracers, Dye releases, Radioactivity techniques, Tritium, On-site tests, Air-water interfaces, Cavitation, Turbulence, Water pollution control, Water pollution treatment, Model studies.
Identifiers: *Krypton.

Field tracer experiments were designed to investigate the relationships between the reaeration capacity of a flowing stream and the stream's hydraulic properties, to develop models for the accurate prediction of stream reaeration capacity. Accurate knowledge of stream reaeration capacity is a necessity in determining the required degree of waste treatment and the associated costs. Reaeration is a direct function of the rate of surface water replacement due to turbulent mixing. Recent development of a gaseous radiotracer technique permits field measurement of reaeration. This procedure involves the simultaneous use of three tracers, namely a fluorescent dye for time of flow, tritiated water for accurate dispersion measurement, and dissolved krypton-85 for measurement of gas transfer. Field results, obtained by this technique are highly reproducible. Field tracer studies of the reaeration capacities of three medium sized streams were conducted over a total of about forty river miles. Associated hydraulic properties such as stream flow, cross-sectional area, depth, velocity, hydraulic gradient and dispersion were also measured. Features such as waterfalls, rapids and pools are included. More than eighty observations of the reaeration capacities of individual stream reaches were made. In streams of the type studied most of the real work of gas transfer and reaeration takes place in relatively short reaches. In general, the magnitude of the gas transfer coefficient is controlled by the rate of surface water replacement and this in turn is controlled by the rate of energy expenditure, measured as the rate of loss of water surface elevation. (Knapp-USGS)
W71-04593

CONTROL OF SPILLAGE OF HAZARDOUS POLLUTING SUBSTANCES,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
J. W. Dawson, A. J. Shuckrow, and W. H. Swift.
Copy available from GPO Sup Doc as I 49.13/415090FOZ10/70, $3.00; microfiche from NTIS as PB-197 596, $0.95. Water Pollution Control Research Series, 15090 FOZ 10/70, Nov 1, 1970. 390 p, 28 tab, 31 fig, 105 ref, 9 append. WQA Program 15070 FOZ 10/70.

Descriptors: *Water quality, *Accidents, *Chemicals, Monitoring, *Costs, *Water pollution control, Water pollution sources, Legislation, *Chemical wastes, Chemical properties.
Identifiers: *Hazardous polluting substances, Countermeasures, *Spills, *Critical concentrations, *Enforcement, *Hazardous materials, Acute discharges, Detection.

An evaluation of the water quality aspects germane to the spillage of hazardous polluting substances is developed. Emphasis is placed on definition and classification of chemical materials; the nature of the sources of spillage and past experience; and analysis of the relative threat to water quality offered by such substances; a review of presently available detection, control, and removal technology; relationship to water quality standards; and the relevant administrative, enforcement, and cost recovery aspects. Over 800 chemical substances were evaluated as to their annual production and transport quantities, their critical concentration in the aquatic environment resulting in water quality impairment for the several beneficial water uses, detection limits (both field and laboratory), and the control and removal methods presently available or potentially practicable. Over 250 chemicals and compounds, generally those in large scale production and utilization, are priority ranked in order of relative threat to water quality in terms of annual production/sales, intrinsic hazard to water quality, transport mode, and past statistical accident frequency. Recommendations are presented regarding future research and development efforts aimed at mitigating damage and a consensus of informed parties is presented relating to the need for additional legislation. This report fulfills Contract No. 14-12-866, between the Federal Water Quality Administration and the Pacific Northwest Laboratories, Battelle Memorial Institute. The right of a citizen to bring an action to abate pollution without showing specific damage to himself ought to be granted under the Refuse Act in both State and Federal law. The qui tam theory should not be expanded. Rather, class action rights should be authorized with no monetary rewards provided to the plaintiff, other than the recovery of costs when he prevails. This is particularly true when the prosecution of hazardous polluting substances (spill cases) is so inadequate at both the State and Federal level. Any damages recovered would go into funds established to effect environmental restoration in the event cleanup or restoration at a specific spill site were impossible or undesirable.
W71-04615

CONCEPTUAL ENGINEERING REPORT - KINGMAN LAKE PROJECT.
Weston (Roy F.) Inc., West Chester, Pa.
For primary bibliographic entry see Field 05D.
W71-04616

THE FEDERATION AND PURE WATERS,
Dwight F. Metzler.
Journal, Water Pollution Control Federation, Vol 40, No 8, Part 1, p 1397-1402, Aug 1968. 6 p, 1 tab.

Descriptors: *Pollution abatement, *Water pollution control, *Administrative agencies, *Personnel, Water quality control, Federal government, Public health, Grants, Manpower, Training, Waste water disposal, Waste water (Pollution), Planning, Administration, Operation and maintenance, Financing, Costs, Public utilities, Education, Social aspects.

The Water Pollution Control Federation has done much to focus public concern on water pollution abatement. Its member associations such as the New York State Water Pollution Control Association have made important contributions. The New York Pure Waters Authority has been created to assist the Pure Waters program by construction of waste water facilities and technical assistance for operation of the facilities on a community level. The program needs to place more emphasis on the recruitment of competent personnel by offering attractive salaries, upgrading the public image of such employment, and promoting of training--especially in the management and supervision areas. The Federation should set up procedure and facilities for a sustained recruitment. Technical training for better plant operation, which is of paramount importance, can be improved by supplementing state training programs. The seminar-workshop approach by state associations can be utilized to put objectives into practice. There is a need for better communication between the Federation members and the public. (Barnett-Florida)
W71-04640

PERMITS FOR DISCHARGES OR DEPOSITS INTO NAVIGABLE WATERS.
Corps of Engineers, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04646

FINANCIAL RESPONSIBILITY FOR OIL POLLUTION CLEANUP.
Federal Maritime Commission, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04647

INTERNATIONAL AND NATIONAL REGULATION OF POLLUTION FROM OFFSHORE OIL PRODUCTION,
Nospaman, Waters, Scott, Krueger and Riordan, Los Angeles, Calif.
For primary bibliographic entry see Field 06E.
W71-04650

OCEAN POLLUTION: AN EXAMINATION OF THE PROBLEM AND AN APPEAL FOR INTERNATIONAL COOPERATION,
For primary bibliographic entry see Field 06E.
W71-04651

THE ECONOMICS OF CLEAN WATER: ANIMAL WASTES PROFILE.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-04685

THE NUCLEAR POWER SCHEDULE STRUGGLE,
For primary bibliographic entry see Field 06B.
W71-04722

TEMPERATURE CONTROL ENHANCES NATURAL BENEFICATION OF COAL MINE DRAINAGE,
Cornell Univ., Ithaca, N.Y.
R. Lachman.
International Congress on Industrial Waste Water, Stockholm, Sweden, Typescript. 12 p, 1 fig, 5 tab, 9 ref.

Descriptors: *Coal mine wastes, *Temperature, Pyrite, Oxidation, Neutralization, Iron, Alkaline water, Impoundments, *Mine drainage.
Identifiers: Natural benefication.

Although it is impossible to say that there is any one key factor in the benefication of coal mine effluents, a major factor was found to be the complex interrelationship of effluent, air, and receiving water temperatures. The acid effluents discharged from coal mines are produced as the result of the oxidation of pyritic materials to either ferrous or ferric sulfate followed by the leaching of these products into streams. The field experiment consisted of the construction of small impoundment dam in which benefication resulting from the controlled mixing of mine and surface waters could be studied under natural environmental conditions. The criteria used for determining that benefication had occurred were changes in acidity, ferrous iron, total iron, aluminum, calcium, magnesium and sulfate content of the mixture while the acidity, ferrous iron, total iron, aluminum, and sulfate are decreasing, the calcium and magnesium remain virtually unchanged. All of the six tests performed show that the highest percent reductions in iron were obtained when the stream and effluent temperature differences were smallest. (Upadhyaya-Vanderbilt)
W71-04725

ENERGY PRODUCTION - A WORLD LIMIT,
Cambridge Univ. (England). Cavendish Lab.
P. F. Chapman.
New Scientist, p 634-636, September 24, 1970. 1 fig, 1 tab.

Descriptors: *Solar radiation, *Thermal pollution, Energy budget, Forecasting, Water pollution control.
Identifiers: *Energy sources, Energy production, Surface temperature, Power input.

Estimates of the total solar energy incident on the Earth fall in the range of 1.49 x 10 to the 18th power to 1.55 x 10 to the 18th power kilowatt-hours per annum. Using the value of 280 K for the surface temperature of earth, it follows from Boltzman's Law that a one percent rise in the power input corresponds to a temperature rise of 0.7K. It is proposed that energy production should be restricted to be less than 5 percent of the total solar input. This limit corresponds to a temperature rise of 3.5 K. The maximum world hydroelectric power capacity, estimated in 1960 on the minimum flow rate of the world's major river systems, it only 0.05 percent of energy incident on the oceans. If we are to avoid increasing Earth's surface temperature by an appreciable amount, then the present trend in world energy production must soon change. In order to obtain more energy without displacing the temperature equilibrium further the equilibrium sources must be utilized. It has been estimated that present technology may be able to extract one percent of the solar radiation. Acceptance of any limit to the world's energy production implies a maximum world population. (Upadhyaya-Vanderbilt)
W71-04727

USEFUL ENERGY FROM UNWANTED HEAT,
WAPORA, Inc., Rockville, Md.
J. I. Bregman.
Chemical Engineering, p 83-87, January 25, 1971. 4 tab.

Descriptors: *Cooling water, *Thermal pollution, Cooling towers, Costs, Standards, Water pollution control.
Identifiers: *Waste heat, *Once-through cooling, Cooling ponds, Drift loss, Aquaculture.

Once through cooling is certainly the most economical way of accomplishing heat dissipation. The results of a study conducted by Federal Power Commission show that about 71 stations in the 1,000 to 4,000 Mw range are capable of being supported by reservoirs, 24 in the 4,000 to 12,000 Mw range, and 8 at 12,000 Mw or greater. Efficiency of a cooling pond may be increased markedly by introducing a spray into the system. Common problems connected with large cooling waters includes wood deterioration, biological fouling, the formation of deposits, corrosion and scaling. Another major problem is drift and togging. A typical tower with a flow of 250,000 gal. per minute operating on seawater with a salinity of 35,000 ppm, and a drift loss of 0.1 percent will emit about 4,400 lb. per hour of sodium chloride. Costs for dry tower runs from $25 to $30 per Kw., compared to $8 to $13 per Kw. for wet towers. Cooling water from a nuclear power plant may be particularly suited to aquaculture. Possibility of placing a chemical plant next to a nuclear plant appears attractive. It is concluded that potential does exist for turning waste heat into a useful commodity. (Upadhyaya-Vanderbilt)
W71-04728

PLASTIC COOLING TOWER SAVES SPACE AND WEIGHT.
Whirlcool, Inc., Franklin Lakes, N.J.

Chemical Engineering, p 48, January 25, 1971. 1 fig.

Descriptors: *Cooling towers, Maintenance, Water loss, Corrosion, Water pollution control.
Identifiers: *Plastic cooling tower, Polyethylene.

Smaller than conventional cooling towers, and wighing 1/7th that of wood or steel construction, this model offers design engineers more leeway in installing cooling towers in tight spaces or on soft foundations. Other features are long, maintenance free service and minimum corrosion problems. The tower is fabricated from a large, one-piece seamless tubular shell of high density polyethylene that is highly resistant to acids, alkalis and salts, as well as algal growth. The units are available in models ranging in capacity from 150 to 600 gpm. Up to 5000 gpm capacity can be installed using a modular arrangement of successive towers. The internal design, or spiral/step flow arrangement, causes air and water to contact countercurrently while swirling around within spiral channels. Water loss, through carryover and drift, is kept low. (Upadhyaya-Vanderbilt)
W71-04729

ECONOMICS OF THERMAL POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. O.G. Lof, and J. C. Ward.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2102-2116, December 1970. 5 fig, 3 tab, 16 ref.

Descriptors: *Thermal pollution, *Thermal powerplants, Economics, Cooling water, Efficiencies, Temperature, Evaporation, Ecology, Costs, Cooling towers, Water pollution control.
Identifiers: Recirculation cooling, Once-through cooling.

Approximately 80 percent of all water used by industry is used for cooling purposes. Plots are given showing the estimated cooling water withdrawal to the year 1980 and for estimates of past and future recirculation. If the cost of supplying cooling water in a once through system, including withdrawal, pumpage, and treatment if necessary, exceeds about $0.01/1000 gallon (0.3 mill/KWH generated in fossil fuel plants) recirculation cooling would usually be employed. On-site cost would be minimized by such decision. Regulations prohibiting unlimited thermal discharge is the other reason for using recirculation cooling. Equations are given for calculating annual investment expense and operating cost for recirculation cooling using a forced-draft cooling tower. The results of a downstream powerplant using warmer condenser water than would naturally have been available are a decrease in total electric generation and a decrease in thermal efficiency, hence, an increase in cost per kilowatt hour. Thermal discharge has the effect of diminishing downstream flows and lake volumes just as does recirculation cooling to avoid thermal discharge. (Upadhyaya-Vanderbilt)
W71-04733

POLLUTION CHARGES INCOME AND THE COSTS OF WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus. Dept. of Economics.
J. H. Boyd.
Water Resources Research Center, Ohio State University, Columbus, Ohio, 1970. 28 p, 2 tab, 3 fig, 15 ref. OWRR Project A-010-Ohio (2).

Descriptors: *Water quality, *Water pollution effects, *Water pollution control, Biochemical oxygen demand, Flow augmentation.
Identifiers: *Effluent charges, Instream aeration.

Polluters should realize the marginal opportunity costs of utilizing rivers for waste disposal, equal to the marginal value of downstream water quality foregone. The author considers that 'pollution charges' (usually called effluent charges) represent a portion of the economic rent of the river, and that additional charges on enjoyers of water quality would be another portion of the economic rent desirable from an equity view point. Investments in facilities to increase the river's assimilative capacity such as instream aeration are costs to the river authority. The author discusses financial balance and Pareto efficiency as important to public policy. Discussion is presented which indicates that an optimizing river authority is apt to have surplus revenues. Section II of the paper examines the relationship between pollution charges income and assimilative capacity augmentation costs for a case of one upstream polluter and one downstrea beneficiary. Section III discusses relationshi between pollution, water quality and low flow au mentation and Section IV extends the model more than one polluter and one beneficiary. (T model assumes ability to evaluate water quali benefits.) (Whipple-Rutgers)
W71-04736

ECONOMICS OF AIR AND WATER POLLU TION.
Virginia Polytechnic Inst., Blacksburg. Wat Resources Research Center.
For primary bibliographic entry see Field 06B.
W71-04739

SOMEBODY FOULED UP THE SEAS,
For primary bibliographic entry see Field 06E.
W71-04740

THE 'FINAL' WATER WELL LAW AND REGU LATIONS (STANDARDS FOR WATER WEL CONSTRUCTION AND PUMP INSTALLA TION),
Ground Water Resources Inst.
For primary bibliographic entry see Field 06E.
W71-04742

THE USE OF SUBSIDIES FOR WASTE ABATE MENT,
Clemson Univ., S. C.
For primary bibliographic entry see Field 06A.
W71-04743

WHERE NOW, CLEAN WATER,
Cornell Univ., Ithaca, NY. Water Resources an Marine Science Center.
David J. Allee, and Leonard B. Dworsky.
Water Spectrum, Army Corps of Engineers, p 10 15, Winter 1970. 3 fig.

Descriptors: *Resources development, *Water pol icy, Conservation, Ecology, Inter-agency coopera tion, *Water pollution.
Identifiers: *Water resources planning, Wate supply systems, Environmental policy, Environ mental quality, Environmental problems.

Years ago it was recognized that piecemeal approaches to water resources development were wasteful and ineffective. To combat this approach the Water Resources Planning Act was passed in 1965. Now that act should be reconsidered--updated with new approaches for dealing with mercury, DDT, and municipal water supplies. Resource development agencies must see the urban region as a necessary unit of action in planning. Specific measures to be taken in the 1970's include: 1) removal of gross pollution from municipal and industrial outlets, 2) use of advanced waste treatment technology, 3) demonstration of regional control of pollution, 4) reduction of DDT, other pesticides, and detergents, 5) reduction in rate of deterioration of Great Lakes, 6) management of waste heat from industry, 7) improved control over oil production and transportation. In order to achieve these goals, the following suggestions are made. The federal government should enforce pollution control in all navigable waters. Also the federal construction grant allocation procedure should be extensively revised. To facilitate innovation, a series of regional water quality management studies ought to be initiated as demonstration projects. The collection of detailed information with sources of polluters identified should be authorized in order to effectively plan a pollution control program. The water supply and waste water utility services of local government should undergo a program of reorientation, and a national program of technology assessment ought to be established to insure the minimization of consequences harmful to life as a result of new materials or machines. (Wray-Chicago)
W71-04748

SYSTEMS ANALYSIS FOR URBAN WATER MANAGEMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 06A.
W71-04755

SYSTEMS ANALYSIS FOR GREAT LAKES WATER RESOURCES.
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 06A.
W71-04756

AN INTERINDUSTRY FORECASTING MODEL WITH WATER QUANTITY AND QUALITY CONSTRAINTS,
West Virginia Univ., Morgantown. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04761

REGIONAL TRADE AND STRUCTURE MODEL FOR POLLUTION ABATEMENT STUDY,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04763

TRADE STUDY RELEVANT TO POLLUTION ABATEMENT IN THE WESTERN BASIN OF LAKE ERIE,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04764

THE UTILITY OF SYSTEMS ANALYSIS IN ESTUARINE WATER QUALITY MANAGEMENT,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-04765

SYSTEMS ANALYSIS, WATER QUALITY AND GOVERNMENT DECISION MAKING,
New York State Dept. of Health, Albany. Environmental Health Services.
For primary bibliographic entry see Field 06A.
W71-04766

RECENT DEVELOPMENTS IN THE LAW OF THE SEAS: A SYNOPSIS,
For primary bibliographic entry see Field 06E.
W71-04782

THE CONTROL OF POLLUTION BY OIL UNDER THE WATER QUALITY IMPROVEMENT ACT OF 1970,
Washington and Lee Univ., Lexington, Va. School of Law.
James S. Dix, and Aron L. Suna.
Washington and Lee Law Review, Vol 27, p 278-303, 1970. 11 p, 51 ref.

Descriptors: *Oil, *Water quality control, *Water Quality Act, *Water pollution, Water pollution sources, Oily water, Water pollution effects, Water pollution control, Federal government, Legislation, Pollution abatement, United States, Oil industry, Coastal structures.
Identifiers: *Water Quality Improvement Act of 1970.

In recent years extensive damage has resulted from the increased utilization of oil in our society. Through spillage and the proliferation of offshore drilling, oil pollution of our waters has become a major problem. The Water Quality Improvement Act of 1970 is an attempt to police and alleviate oil pollution by enabling the government to recover cleanup costs from the polluter. The authors herein delineate the scope, relate the legislative history, and hypothesize as to the application of the liability provisions of the Act. The provisions of the Act are discussed, and a chart is presented summarizing exceptions to the applicability of the Act. The chart sets out limits of liability, designating where unlimited liability is applicable. The provisions of the Act are critically analyzed and suggestions for improvement are included. (Barnett-Florida)
W71-04784

THE SETTLEMENT OF DISPUTES BETWEEN FEDERAL AND STATE GOVERNMENTS CONCERNING OFFSHORE PETROLEUM RESOURCES: ACCOMMODATION OR ADJUDICATION,
For primary bibliographic entry see Field 06E.
W71-04786

FINANCIAL RESPONSIBILITY FOR OIL POLLUTION CLEANUP (EXEMPTION OF NONSELF PROPELLED BARGES FROM FINANCIAL RESPONSIBILITY REQUIREMENTS).
Federal Maritime Commission, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04792

CERTIFICATION OF FACILITIES (PROPOSED REGULATIONS FOR CERTIFYING POLLUTION CONTROL FACILITIES FOR TAX DEDUCTION PURPOSES).
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04793

EXECUTIVE ORDER 11574 (ADMINISTRATION OF REFUSE ACT PERMIT PROGRAM).
For primary bibliographic entry see Field 06E.
W71-04794

TURBULENT DIFFUSION AND ENTRAINMENT IN TWO-LAYER FLOW,
Norges Tekniske Hoegskole, Trondheim. River and Harbor Lab.
T. Carstens.
Proceeding, American Society of Civil Engineers, Journal of Waterways and Harbors Division, 96 (WWL) p 97-104, February 1970. 7 fig, 1 tab, 8 ref.

Descriptors: *Estuaries, *Flow control, *Turbulent flow, *Diffusion, *Entrainment, Salinity, Tracers, Sea water, *Path of pollutant, Water pollution control, Flow.

A freshwater layer over a pool of seawater may extract salt by diffusion and entrainment. Diffusion is a two-way transport with equal volumes exchanging places, entrainment is a one-way advectival type of transport. The rates of the two vertical transports depend on the turbulence in the surface layer and in the pool. The more turbulent water mass will erode and entrain the less turbulent one. The distribution of salinity in an estuary is helpful in the location of freshwater intakes and can be used as a tracer to estimate transport rates of other flow pollutants. (Ensign-PAI)
W71-04803

CONTROLLING OIL POLLUTION OF HARBORS THROUGH BIOLOGICAL MEANS.
Naval Research Reviews, Vol 23, No 5, p 24-26, May 1970. 1 fig.

Descriptors: *Water pollution control, *Oil, *Cleaning, *Biodegradation, *Fertilization, Nitrogen, Phosphorus, Microorganisms, Self-purification, Oil wastes.
Identifiers: Accelerated biodegradation, *Oil pollution.

The U. S. Navy has begun a research program for better methods of controlling oil pollution of harbors and beaches. The program will concentrate on decomposition of oil through natural processes. Biodegradation of the oil is the most significant self-purification process active in the oceans. The study, conducted by Rutgers University, is to find ways to speed up biodegradation. Seeding dispersants with cultures of oil-degrading microorganisms may accelerate biodegradation. Ways of fertilizing with mineral nutrients such as nitrogen and phosphorus are being studied and offer extensive laboratory experiments. Field tests will be made on shores and estuaries in New Jersey. (Ensign-PAI)
W71-04805

REGIONAL ACTION: KEY TO THE FUTURE OF SAN FRANCISCO BAY/I,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 06B.
W71-04809

REGIONAL ACTION: KEY TO THE FUTURE OF SAN FRANCISCO BAY/2,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 06B.
W71-04810

CALIFORNIA DEPT OF FISH AND GAME V S S BOURNEMOUTH (SHIP'S LIABILITY FOR DAMAGES RESULTING FROM OIL SPILL).
For primary bibliographic entry see Field 06E.
W71-04840

ENVIRONMENTAL SERVICE (CREATION OF STATE AGENCY FOR WASTE TREATMENT CONTROL).
For primary bibliographic entry see Field 06E.
W71-04841

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A MODEL FOR CAPACITY EXPANSION PLANNING OF WATER DISTRIBUTION NETWORKS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics; and Massachusetts Univ., Amherst Dept. of Civil Engineering.
Fu-Hsiung Lai, and John C. Schaake, Jr.
Available fron NTIS as PB-197 557, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Institute of Technology, (MIT), Ralph M. Parsons Lab for Water Resources and Hydrodynamics Report No 131, October 1970. 234 p, 54 fig, 22 tab, 71 ref, append. OWRR Project No B-014-MASS (1).

Descriptors: *Systems analysis, *Optimization, *Mathematical models, *Water distribution (Applied), *Network design, Distribution systems, Public utilities, Water demand, Water delivery, Water management (Applied), Water supply, Dynamic programming, Computer programs.
Identifiers: *Water system expansion.

Methodology was developed for planning the capacity expansion of water distribution networks to meet anticipated future water needs. Optimal present investment decisions could be related to the annual discount rate, economy-of-scale in the cost of capacity expansion, existing network capacity, and the demand growth patterns. The general nature of water distribution network planning and the problem of single period planning for a tree network were reviewed. Dynamic programming was applied to the problem of multiperiod, single component planning. A model was developed for tree network planning. (Knapp-USGS)
W71-04351

A SYSTEMS ANALYSIS OF THE LOWER GANGES-BRAHMAPUTRA BASIN,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 02E.
W71-04410

IMPACT OF IRRIGATION DEVELOPMENT ON INCOME AND TRADE, EASTERN AND CENTRAL SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Economics.
For primary bibliographic entry see Field 03F.
W71-04421

SIMULATION OF BIOLOGICAL PROCESSES BY ANALOG AND DIGITAL COMPUTERS,
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
L. T. Fan, P. S. Shah, and L. E. Erickson.
Institute for Systems Design and Optimization, Report No 20, July 1970. 120 p, 39 fig, 5 tab, 41 ref, 2 append. OWRR Project A-019-KAN (2).

Descriptors: *Analog computers, *Digital computers, Simulation analysis, *Biological treatment, Waste treatment, Flow.

In the first part of this report the analog computer, its basic components and their functions were reviewed and discussed. The state variable approach was used for the analog computer programming to solve the higher order differential equations. Suggestions were made for drawing an analog circuit diagram by dividing it into subdiagrams which were classified as the main subrouting, special function subroutine and the memory subroutine. The analog computer simulation was illustrated by the biological wastetreatment processes. The transient behavior of the system was observed for constant influent organic concentration and for constant influent flow rate during the start-up or restarting of the plant. Phase-plan plots for different flow rates were also obtained. The transient behavior of this system was observed for a cyclic influent flow rate. The second part of the report contained a general description of the continuous system modeling program for the simulation of the continuous system. The detail programming information and a description of the inputs and outputs was given. The simulation by digital computer was illustrated by simulating the batch kinetics for the growth of microorganisms on hydrocarbon substrate (a four phase reacting system). The effect of cell adsorption to the surface of the dispersed phase, substrate transport between phases, phase equilibrium and growth kinetics could be considered using this model. (Kriss-Cornell)
W71-04422

EFFICIENCY AND EQUITY IN THE OPTIMAL SUPPLY OF A PUBLIC GOOD,
Maryland Univ., College Park.
Martin C. McGuire, and Henry Aaron.
Review of Economics and Statistics, Vol LI, No 1, p 31-39, February 1969.

Descriptors: *Economic efficiency, *Welfare economics, *Economic evaluation, Costs, Benefits, Taxes, Government, Marginal cost, Income, Mathematical study, Decision-making, Optimization, Maximization.
Identifiers: *Lendahl solution, *Pareto efficiency, *Public goods, Marginal utility, Income transfers, Marginal rate of substitution.

The Lindahl voluntary exchange decision rule, which leaves the initial income distribution unchanged makes possible the separation of decision rules for allocative efficiency and distributional equity in relation to a public good. This can be demonstrated from the following: (1) the marginal costs of production need not equal the sum of the individuals marginal rates of substitution; (2) with either direct lump sum income transfers or variable cost sharing tax burdens, the choice of a final utility distribution dictates a unique Pareto optimal public goods supply decision; (3) if both tax shares are variable and lump sum income transfers are allowed then the optimal utility distribution is Pareto-efficient and can be achieved through a Lindahl solution to the public good supply problem. These propositions are demonstrated both diagramatically and mathematically. The author summarizes the implications for the theory of taxation and expenditure. The conclusions of this paper would indicate a distinct method of cost allocation and benefit distribution for water resources projects and is therefore relevant to the water resources economist. (Murphy-Rutgers)
W71-04458

SYSTEMS ANALYSIS TECHNIQUES FOR PLANNING-PROGRAMMING-BUDGETING,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 06B.
W71-04469

THE SYSTEMS ANALYSIS APPROACH,
Department of Defense, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-04475

UNCERTAINTY AND THE NEED FOR COLLECTIVE ACTION,
Harvard Univ., Cambridge, Mass.
Richard Zeckhauser.
In: Public Expenditures and Policy Analysis, 1970, 96-116.

Descriptors: *Uncertainty, Economic evaluation, *Government, Optimization, Demand, Risk, Insurance, Flood control, Forecasting, Probability, Benefits, Capital, Income, Taxes, Marginal costs.
Identifiers: *Contingent claims, *PIP goods, *Individual preferences, Equity considerations.

The author believes that the expansion of knowledge on the subject of uncertainty has not stressed the role of the government. This paper attempts to show that the presence of uncertainty creates special obligations and possibilities for collective or governmental action. The author first considers those situations in which individuals who are unable to predict their individual portions of future total demand may find it useful to make some decisions on the collective provision of a good before preferences become known. There is a discussion of the factors which make it advantageous to provide goods, for which accurate provision of future preferences is impossible, on a collective basis. The paper also evaluates the effect of trades in contingent goods having a risk-sharing objective on incentives for individual effort. The government's attitude towards risk is examined and, in the concluding section, the effect of possible governmental action on expectations is evaluated. Uncertainty is a problem in water resource analysis, as evidenced by the author's numerous references to flood control programs and this paper represents a useful source for information concerning the potential issues of uncertainty in the water resource area. (See also W71-04477) (Murphy-Rutgers)
W71-04478

EVALUATION OF THE DECISION PROCESS IN WATER RESOURCES PLANNING,
Stanford Univ., Calif. Dept. of Civil Engineering.
Ray K. Linsley.
Available from NTIS as PB-197 530, $3.00 in paper copy, $0.95 in microfiche. Engineering Economic Planning Report EEP-38, December 1970. 41 p. OWRR Project C-1635 (No 3150) (3).

Descriptors: *Project planning, *Forecasting, *Projections, Probability, Methodology, *Decision making, Reliability, Water supply, Construction costs, *Water storage, *Synthetic hydrology, Water supply, *Reservoirs, Municipal water, Risks, Evaluation.
Identifiers: Baltimore (Md), Phoenix (Ariz).

A summary report of research reviewing a study o methods of stochastic analysis in hydrology, appli cation of the methods of alternative futures for esti mates of urban residential water requirements an the use of statistical methods for estimating costs o dams and reservoirs. The results are a probabilisti estimate of water demand for situation simulatin Baltimore, Maryland and Phoenix, Arizona wer combined with estimates of the uncertainty i determining required reservoir size to indicate th probability of distributions of required storage i these two situations. It is shown that the range o required storage is very large.
W71-04516

NUMERICAL SIMULATION OF DISPERSION IN GROUNDWATER AQUIFERS,
Colorado State Univ., Fort Collins. Dept. o Agricultural Engineering; and Colorado Stat Univ., Fort Collins. Dept. of Civil Engineering.
Donald Lee Reddell, and Daniel K. Sunada.
Colorado State University Hydrology Paper No 41 June 1970. 79 p, 35 fig, 1 tab, 96 ref, 8 append OWRR Project A-001-COLO (8).

Descriptors: *Simulation analysis, *Dispersion *Groundwater movement, *Numerical analysis Mixing, Computer programs, Computer models Mathematical models, Saline water intrusion Aquifers, Porous media, Diffusion, Convection Diffusivity.
Identifiers: Longitudinal dispersion.

A flow equation for a mixture of miscible fluids wa derived by combining the law of conservation o mass, Darcy's law, and an equation of state describing the pressure-volume-temperature-concentration relationship. The result is an equation involving two dependent variables, pressure and concentration. A relationship for determining concentration was derived by expressing a continuity equation for the dispersed tracer. An implicit numerical technique was used to solve the flow equation for pressure, and the method of characteristics with a tensor transformation was used to solve the convective-dispersion equation. The results from the flow equation were used in solving the convective-dispersion equation and the results from the convective-dispersion equation were then used to resolve the flow equation. The computer simulator successfully solved the longitudinal dispersion problem and the longitudinal and lateral dispersion problem. Using the tensor transformation, problems of longitudinal and lateral dispersion were successfully solved in a rotated coordinate system. The computer simulator was used to solve the salt-water intrusion problem. The numerical results for the fresh water head in the aquifer closely matched those obtained analytically. (See W70-04051) (Knapp-USGS)
W71-04559

TOOLS FOR WATER RESOURCE STUDY,
Illinois State Water Survey, Urbana.
Julius H. Dawes.
ASCE Annual and Environmental Meeting, Chicago, October 13-17, 1969. Meeting Preprint 1074. 43 p, 18 fig, 3 tab, 10 ref.

Descriptors: *Planning, *Water resources development, *Water utilization, *Administration, *Mathematical models, *Water costs, Reservoir design, Pumping, Conveyance, Sewage treatment, Wells, Pumps, Analytical techniques, Illinois.

The Illinois Water Survey determined that a need exists for a series of water resource models--describing development, use and management functions. Studies were initiated on the cost and benefit of various elements of water resource development. Some of the studies completed are as follows: costs of reservoirs in Illinois, costs of wells and pumps, water transmission costs, costs of pumping water, and cost of sewage treatment. It is necessary to develop working tools in order to progress in the creation of a water resource use, development and management model. It is in-

led that these tools be used as a basis for comson between alternatives. The results will have same degree of certainty as incorporated in the c cost data. Cost estimates derived by these niques should not take the place of detailed nates prepared by engineers for specific condis. Cost estimates for reservoirs, wells and ps, transmission lines, pumping water, water ment, and sewage treatment will be helpful in ng quality, quantity and economic parameters e physical system. Through their application, it ld be possible to examine the alternative solu- to meet the objective determined by omic, social and political criteria. (Poertner)
-04679

EAR PROGRAMMING APPLIED TO LTI-STAGE CAPACITY EXPANSION OF TER TREATMENT-DISTRIBUTION TEM,
is Univ., Urbana. Dept. of Business Adminisn.
rimary bibliographic entry see Field 05F.
-04737

IMIZING ABATEMENT COSTS OF ER POLLUTANTS FROM AGRICULTURE: ARAMETRIC LINEAR PROGRAMMING ROACH,
State Univ., Ames. Dept. of Economics.
Seay, Jr.
Thesis, 1970. 156 p, 25 tab, 6 fig, 115 ref, 2 nd. OWRR Project B-015-IA (1).

riptors: *Sediment control, *Water pollution ol, Cost analysis, Cost repayment, Institu- Water quality.
ifiers: *Pollution charges, Effluent charges.

tudy focuses upon suspended sediment from ultural lands as an example of nondegradable, e source pollutant. After considerable discusof externalities and public goods, the author s to the conclusion (1) that 'the tax-bounty on for dealing with external effects' is invalid, 2) that the cost-benefit analysis is inapplicable study of pollution abatement because it is a good. Therefore his major analysis is a cost iveness study, assuming that exogenously ied water quality criteria represent indicators cietal preferences. The Nishnabotna River Iowa, is used as the study area. By changing uality level constraints, least-cost estimates of ving successively higher quality standards are ed. In order to share costs of abatement mea- a basin-wide management authority appears The author casts doubt upon the frequently ed principle that the polluter should pay although no disproof of this position is of- (Whipple-Rutgers)
04738

USE OF SUBSIDIES FOR WASTE ABATE-T,
on Univ., S. C.
Macaulay.
onomics of Air and Water Pollution, Water rces Research Center, Virginia Polytechnic te, Blacksburg, Va., p 56-73, Oct 1969.

ptors: Decision making, *Resource alloca- conomic efficiency, Public benefits.
iers: *Effluent charges, *Subsidies.

fficulty in finding solutions to water pollution ms such as have been found for conflicting se demands stems from cultural lag, uncer- over ownership and legal rights, and exter-. There must be some level of water quality ch the total level of satisfactions of society greatest. The question is how to achieve this f satisfactions. (The author does not discuss measure such satisfactions.) The means le are taxes, subsidies and regulations. Argu- in favor of the method of subsidies mostly ed upon equity, those against subsidy mostly concern efficiency, since subsidies may encourage non-optimal over production of the goods concerned. Subsidies could be given in the form of accelerated depreciation, tax credits, and indirect assistance through government assistance to municipal plants handling industrial wastes. (See also W71-04739) (Whipple-Rutgers)
W71-04743

SYSTEMS ANALYSIS FOR URBAN WATER MANAGEMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.

Available from NTIS as PB-197 677, $3.00 in paper copy, $0.95 in microfiche. Completion Report, September 1970. 78 p, 12 fig, 9 tab, 46 ref, 1 append. OWRR Project C-1536 (No 1992) (4).

Descriptors: *Systems analysis, *Water management (Applied), *Simulation analysis, *Mathematical models, Storm runoff, Municipal water, Economics, Cities, Urbanization.

The major purpose of this study was to indicate that the goals of urban water management, with respect to the use and further development systems analysis tools explored, are attainable. It was primarily a technicalenterprise to demonstrate that a comprehensive model could be constructed in a general enough format to allow its application to many urban water systems while at the same time urban water subsystem submodels, comprising the larger model, could be operated independently to describe behavior of specific urban susbystems. Economic aspects were also considered. A comprehensive simulation model was developed for a specific hypothetical Urban Water Resources System structured to indicate the interrelationships among inflows, storage volumes, outflows, and qualities in various subsystems. A more expensive but more refined storm water modeling project was described. An economic systems model was formulated to evaluate physical works projects intended to meet urban water objectives subject to technical and budgetary constraints. Results of the hypothetical demonstrations of the technical and economic models were given. Major conclusions and recommendations were presented. (Kriss-Cornell)
W71-04755

SYSTEMS ANALYSIS FOR GREAT LAKES WATER RESOURCES.
Ohio State Univ., Columbus. Water Resources Center.

Available from NTIS as PB-197 678, $3.00 in paper copy, $0.95 in microfiche. Proceedings of the Fourth Symposium on Water Resources Research of the Ohio State University, Water Resources Center, October 1969. 135 p, 10 fig, 18 tab, 52 ref, 2 append. OWRR Project A-999-OHIO (3).

Descriptors: *Systems analysis, *Water resources development, *Optimization, *Great Lakes, Pollution abatement, Economics, Ohio, Water pollution control.

The Symposium was an outgrowth of interest in pollution abatement measures for the Great Lakes. It represented an effort to resolve the optimum approach to be taken in the solution of water problems. Section I dealt with the biological-chemical-physical subsystem and included development of a comprehensive simulation model of the fish resources of the Great Lakes, microbial-chemical interactions as systems parameters for Lake Erie, an oxygen-based performance model for Western Lake Erie, and preliminary policy models for Great Lakes regulation. The economic subsystem was dealt with in Section II which described an interindustry forecasting model with water quality and quality constraints, some determinants of Detroit's regional share of economic activity in selected industries, a regional trade and structure model for pollution abatement in the Western basin of Lake Erie. Section III entitled 'Integration of the Model' included the topics of the utility of systems analysis in estuarine water quality management, and systems analysis, water quality and government decision making. (See also W71-04757 thru W71-04766) (Kriss-Cornell)
W71-04756

DEVELOPMENT OF A COMPREHENSIVE SIMULATION MODEL OF THE FISH RESOURCES OF THE GREAT LAKES,
Washington Univ., Seattle, Center for Quantitative Science in Forestry, Fisheries and Wildlife.
Gerald J. Paulik.
In: Systems Analysis for Great Lakes Water Resources, p 11-20, October 1969. 10 p, 7 ref. OWRR Project A-999-OHIO (3).

Descriptors: *Simulation analysis, *Model studies, *Fisheries, *Fish management, Project planning, Great Lakes, Economics, Decision making, Lakes.

A continuing series of simulation models for use as basic planning devices by fisheries management agencies was proposed. The models developed would be open-ended, modular and evolutionary. Although these models would be for managing fisheries, major sectors of the lacustrine ecosystem as well as regional economics would be included as integral parts. First in the discussion was a description of the characteristics of fisheries, especially those of the Great Lakes. Then general characteristics of a simulation model for management agencies, which would provide an easily used accounting system, and experimentation with short-range and long-range effects of management policies, were given. For a model building program, it was suggested that various government agencies involved in fishery resources of the Great Lakes form in conjunction with a group of universities with model building expertise a consortium to construct a series of large-scale simulation models of the Great Lakes fisheries. During the first few years of the model building program, the uses of the models would be: (1) to serve as a data bank and line atlas; (2) to aid decision makers in evaluating tactical alternatives; and (3) to help assign priorities to basic research projects. (See also W71-04756) (Kriss-Cornell)
W71-04757

SOME MICROBIAL-CHEMICAL INTERACTIONS AS SYSTEMS PARAMETERS IN LAKE ERIE,
Ohio State Univ., Columbus. Microbial and Cellular Biology.
P. R. Dugan, J. I. Frea, and R. M. Pfister.
In: Systems Analysis for Great Lakes Water Resources, p 21-28, October 1969. 8 p, 2 fig, 16 ref. OWRR Project A-999-OHIO (3).

Descriptors: *Systems analysis, Data collections, *Algae control, *Lake Erie, Biochemical oxygen demand, Bacteria, Ecology, Water pollution effects, Lakes, *Cyanophyta, *Eutrophication, Water quality.

Some microbial-chemical interactions as systems parameters in Lake Erie were presented. One of the major problems cited was the increased growth rate of blue green algae and other microorganisms in the lake which have led to objections because of decreased recreational value, mortality of fish and domestic animals, clogging of water supply intake filters, and depletion of oxygen in the water. Four general parameters were considered in relationship to accelerated growth of blue green algae: (1) amount of light (energy); (2) nitrogen supply; (3) CO2 or CO3; and (4) minerals. Several observations were made from data collected in the western basin of Lake Erie during the spring and summer of 1969. Using BOD as an example of recycling, role of bacteria in making nutrients available for algae growth was shown significant; and algae, once above a critical concentration significantly enrich their own environments with organics, which in-

dicated a spiraling increase in rate of eutrophication. Suggestions for decreasing algae and bacteria population in the lake were: preventing organic and mineral nutrients from entering the water column and removing sediments of relatively high organic content physically or allowing them to decrease naturally. (See also W71-04756) (Kriss-Cornell)
W71-04758

DEVELOPMENT OF AN OXYGEN-BASED PERFORMANCE MODEL FOR THE WESTERN LAKE ERIE PHYSICO-BIOLOGICAL SYSTEM,
Ohio State Univ., Columbus. Dept. of Microbiology.
C. I. Randles, T. Y. Li, K. S. Shumate, and S. Stollmack.
In: Systems Analysis for Great Lakes Water Resources, p 29-35, October 1969. 7 p, 1 fig. OWRR Project A-999-OHIO (3).

Descriptors: *Systems analysis, *Mathematical models, *Oxygen, Data collections, *Lake Erie, Organic loading, Social aspects, Economics, Lakes, *Input-output analysis, Water quality.

A performance model for the western Lake Erie physico-biological system that will provide a sound base for determining the 'best' uses of the system in a socio-economic sense using a systems analysis approach was proposed. Mathematical modeling of processes in the basis, or submodels of the system, provided the basis for selecting significant parameters, via quantitized analyses, included in the overall system model. Oxygen provided the best combination of characteristics needed for the common measure of performance of the system because of its usability, inclusiveness, and scientific soundness. Major inputs, outputs, processes and influencing factors for measuring the state and changes in state of the physico-biological were illustrated and general comments were made about the system. Two special cases, one where there were no inputs or outputs of either organic materials or oxygen (a closed system), and one where the system is in a steady state (inputs and outputs of oxygen and organic materials were balanced) were mentioned although could not be used for western Lake Erie. Specific data needed for the conceptual model were: organic and oxygen inputs in influent rivers; organic and oxygen outputs to central basin; organic inputs or outputs to sediments, organic outputs in the form of fish, insects, algae, etc., oxygen inputs from or outputs to the atmosphere; and photosynthesis and respiration. (See also W71-04756) (Kriss-Cornell)
W71-04759

PRELIMINARY POLICY MODELS FOR GREAT LAKES REGULATION,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
Daniel P. Loucks.
In: Systems Analysis for Great Lakes Water Resources, p 37-45, October 1969. 9 p, 1 fig, 6 ref. OWRR Project A-999-OHIO (3).

Descriptors: *Stochastic processes, *Mathematical models, *Optimization, *Great Lakes, *Regulated flow, Short-term planning, Long-term planning, Lakes.
Identifiers: Policy models.

Development of preliminary models to partially regulate lake levels and outflows of the Great Lakes were proposed. First some discussion of the existing regulation policy was useful for understanding potential and limitations of future increased regulation. The general interest groups affected by variations in lake levels and outflows were said to be shore property or riparian interests, navigation interests, and power interests. The first set of policy models examined were for defining alternate short-run policy functions and the second set were for long-run policy models. These stochastic optimization models for defining policies could be jointly used to effectively define and evaluate Great Lakes regulation policies. Short-run policies for the entire lake system would be restricted to indicating how much to release from Lake Superior (most upstream lake) and Lake Ontario (most downstream lake), and how much to divert into and/or from each of the lakes, in order to minimize the expected loss resulting from deviations from the target range of lake levels and outflows. The long-run models would specify not only the preliminary operating policy but also the targets and capacities that together with the policy achieves the objective. (See also W71-04756) (Kriss-Cornell)
W71-04760

AN INTERINDUSTRY FORECASTING MODEL WITH WATER QUANTITY AND QUALITY CONSTRAINTS,
West Virginia Univ., Morgantown. Dept. of Economics.
William Miernyk.
In: Systems Analysis for Great Lakes Water Research, p 49-58, October 1969. 10 p, 1 fig, 7 ref. OWRR Project A-999-OHIO (3).

Descriptors: *Input-output analysis, *Leontief models, Constraints, *Water quality, *Water supply, *Colorado River Basin, *Forecasting, Economics, Industries, Water pollution control.

A method used to make long-range projections of economic activity in the Colorado River Basin with water quantity and quality constraints was described. Six sets of projections were made, one for each sub-basin of the Colorado River Basin, with 1980 and 2010 as the target years. The forecasting model was the conventional open Leontief input-output model with changing input coefficients. Separate transaction tables were constructed for each of the six sub-basins, with 1960 as the base year. Non-agricultural and agricultural data were collected and linked together by balancing import rows and export columns, the result being a 'pure' interregional interindustry model. A flow diagram of the computational procedures, which involved eleven steps for input-output projections, was shown. Two sets of projections were completed, one for water quality only and the other involving both quantity and quality constraints. Three general illustrative cases, for agricultural sectors, commercial and industrial users, and municipal users, were sketched. In order to measure damages due to water quality degradation, total gross output as given by the quantity constrained projections, minus total gross output in the quality-constrained projections was used. (See also W71-04756) (Kriss-Cornell)
W71-04761

SOME DETERMINANTS OF DETROIT'S REGIONAL SHARE OF ECONOMIC ACTIVITY IN SELECTED INDUSTRIES,
Wayne State Univ., Detroit, Mich. Dept. of Economics.
John Mattila.
In: Systems Analysis for Great Lakes Water Resources, p 59-73, October 1969. 15 p, 10 tab, 1 append. OWRR Project A-999-OHIO (3).

Descriptors: *Regional analysis, *Taxes, *Industrial production, Income, Growth rates, Correlation analysis, Regression analysis, Michigan, Costs, Industries.
Identifiers: *Detroit.

The impact of additional taxes in conjunction with wages, interest and capital investment, on changes in income and employment for selected industries in the Detroit metropolitan area, possibly because of the cost of fighting water pollution, was examined. These industries, the major exporters of the area, included: motor vehicle, machinery, fabricated metals and primary metals. The dependent variables in the model were the national growth component, the industry-mix component (difference between industry's national growth rate and overall national growth rate), and the regional-share component (difference between industry's national and local growth rates). These variab were expressed in terms of income or employm gained or lost as a result of differential gro rates. Total state and local taxes and total prope taxes collected annually in Macomb, Oakland a Wayne counties were used as the two alternati tax variables. Simple correlation coefficie between regional share variables devulged so agglometation relationships existing amo Detroit's export industries. From these regress coefficients, first approximations to state and lo tax impact multipliers were computed. This a proach demonstrated considerable year-to-y variation in state and local taxes in Detroit relati to state and local taxes in the rest of the natio (See also W71-04756) (Kriss-Cornell)
W71-04762

REGIONAL TRADE AND STRUCTURE MODI FOR POLLUTION ABATEMENT STUDY,
Ohio State Univ., Columbus. Dept. of Economics
Richard T. Stillson.
In: Systems Analysis for Great Lakes Wat Resources, p 75-89, October 1969. 15 p, 2 fig, append. OWRR Project A-999-OHIO (3).

Descriptors: *Optimization, *Simulation analys *Model studies, Regional analysis, *Pollutio abatement, Economics, Lake Erie, Costs, Co straints, Lakes, Water pollution control, Wat quality.

Outlines of a regional trade model useful in dete mining the likely economic impact of vario proposed pollution abatement programs for th Western Basin of Lake Erie were presented. Th model was designed to analyze the likely econom impact of implementation of 'The Lake Erie R port: A Plan for Water Pollution Control' whic proposed several abatement programs includin construction for sewers, secondary and tertiar treatment facilities of municipal waste and enforc ment of a high standard of industrial treatmen facilities. Interregional activity analysis was broke down for each region into: (1) production of fina products, (2) production of intermediate product and (3) shipment of every commodity from eac region. A sample input-output matrix of such ac tivities was shown. This activity analysis was use to formulate a programming model to allocat given resources among activities. The variabl maximized was the gross return to regiona resources and to shipping. The four constraints o the activity levels were: (1) material balances, (2 final resource constraints, (3) capacity constraints and (4) non-negativity constraints. The model wa used to simulate short run impact of abatemen programs with four major effects on a regiona economy: (1) taxation effect, (2) water input ef fect, (3) industrial control effect, and (4) abate ment as a user of resources. The model was to b simulated for the Detroit-Toledo area using input output coefficients for 1963. (See also W71 04756) (Kriss-Cornell)
W71-04763

TRADE STUDY RELEVANT TO POLLUTION ABATEMENT IN THE WESTERN BASIN OF LAKE ERIE,
Ohio State Univ., Columbus. Dept. of Economics.
Thomas C. Webster.
In: Systems Analysis for Great Lakes Water Resources, p 91-110, October 1969. 10 p, 7 tab OWRR Project A-999-OHIO (3).

Descriptors: *Regional analysis, *Pollution abatement, *Lake Erie, Industrial production, Data collections, Statistics, Lakes, Water pollution control, Costs, Water quality.
Identifiers: *Trade study.

Data, which will provide a description of those industries important to the economy of the Western Basin and engaged in regional trade for use in the Regional Trade Study of the Western Basin of Lake Erie, was given. The geographic area constituting the industrial sector of the Western Basin was

fined as the metropolitan areas of Detroit and ledo. Industries included in the model were as- ned to have similar technologies and therefore affected by pollution abatement programs in ilar ways. In Table 1, these industries were clas- ed according to the Standard Industrial Classifi- ion (SIC) system and a description of each pro- ed a breakdown of the various products they duce. Table 2 listed data for the adjusted value led by manufacturing for each selected or major ustry group in the Detroit-Toledo SMSA and percentage of the total value added by manu- turing for each selected industry. The distance ch the commodities produced by the various in- tries are transported, as given by the '1962 Cen- of Transportation' was given in Table 3. Table 4 wed the degree of concentration of the various stries within the fifteen largest producing re- s for each industry. Aggregates that will be in the regional trade model were shown in le 5. Adjusted values added by each industry percentage of the total value added to each in- ry aggregation were given in Tables 6 and 7 ectively. (See also W71-04756) (Kriss-Cor- -04764

UTILITY OF SYSTEMS ANALYSIS IN UARINE WATER QUALITY MANAGE- T,
hattan Coll., Bronx, N.Y. Dept. of Civil En- ering.
rt V. Thomann.
Systems Analysis for Great Lakes Water urces, p 119-128, October 1969. 10 p, 2 fig, 1 ref. OWRR Project A-999-OHIO (3).

riptors: *Systems analysis, *Mathematical ls, Water quality, *Waste disposal, Optimiza- Fish management, Dissolved oxygen, vare River, Estuaries, Water pollution con-

ifiers: Non-steady state model, *Delaware y.

al approaches used to synthesize some major es of the fields of sanitary engineering, lim- y, hydrodynamics, ecology, and operations ch into a unified methodology of water quali- nagement were discussed. The basic objec- of the analytical framework were to: (1) nine underlying casual relations between discharges and water quality; (2) develop ds of forecasting water quality on long-term hort-term basis; (3) analyze interactions en water quality and water use; and (4) p methods and guidelines for optimal ement. Equations were developed which ex- d the cause and effect relationships between such as waste discharge, and output, such as ed oxygen. A systems approach was applied er quality problems of the Delaware Estuary area from Trenton, New Jersey to Liston Delaware. The survival of anadromous fish, the American shad, was cited as an example effect of discharge of municipal and industri- es resulting in poor water quality. A non- state mathematical model was developed ssolved oxygen as the indicator variable. A Kutta approximation was used to numeri- tegrate sets of equations. Using a survival n and arrival times of fish, an average per- rvival of the total population was estimated. entation of this program to the Delaware was described. (See also W71-04756) Cornell)
4765

MS ANALYSIS, WATER QUALITY AND RNMENT DECISION MAKING,
ork State Dept. of Health, Albany. Environ- Health Services.
letling, and Dwight Metzler.
tems Analysis for Great Lakes Water es, p 129-135, October 1969. 7 p, 1 fig, 9 RR Project A-999-OHIO (3).

Descriptors: *Systems analysis, Water quality, *Decision making, *Governments, Management, Economics, Technology, Surveys, Water pollution control.
Identifiers: Potomac River Basin.

Inter-actions between systems analysis, water quality and government decision making were considered not quantitatively, but based on a subjective interpretation. The method utilized was to examine the relationships implied via a case study of a presently pertinent water quality problem watershed--'The Potomac River Basin'. The proposal model was arbitrary, subjective and non-quantitative. Government was divided into four distinct sectors of activities--Management, Technical Analysis (socio-economic-engineering), Surveillance and Implementation. Actual water quality situations of the Potomac were fitted into the four sectors of the proposed structure. From the case study it appeared that: (1) systems analysis was more predominant in technical studies and surveillance than in governmental activities; (2) little use of these methods have been made by management and in implementation; (3) no attempt was made to utilize the method for the entire system; and (4) detailed technical studies are not utilized in decision making. (See also W71-04756) Kriss-Cornell)
W71-04766

EFFECTS OF AXIAL DISPERSION ON THE OPTIMAL DESIGN OF THE ACTIVATED SLUDGE PROCESS,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05D.
W71-04768

APPLICABILITY OF SHORT-MEMORY MODES TO ENGLISH RIVER-FLOW DATA,
Birmingham Univ. (England).
N. T. Kottegoda.
Institution of Water Resources Engineers Journal, Vol 24, No 8, p 481-489, November 1970. 9 p, 8 fig, 7 ref.

Descriptors: *Mathematical models, *Time series analysis, *River flow, Statistics, Annual, Monthly.
Identifiers: *Hurst phenomenon.

A mathematical model for time-series of river flows was undertaken in order to predict the characteristics of future water supplies as a pre-requisite to the planning of water resource projects. In this first stage several statistical tools, such as the range covariance, and special analysis, were used to examine the structure of river-flow records. Three separate estimates of an exponent H (the Hurst phenomenon), which is expected to lie in the range 0.5 to 1.0 and is a measure of the steadiness of the river flows, were made for these five rivers: Elan Valley, River Severn at Bewdley, the Alwen, the Brenig, and the River Derwent at Yorkshire Bridge. Initially, annual values used for the analysis and results in respect to two of the catchments were shown (Elan Valley and River Severn at Bewdley). A biassed value of H seemed to be propagated by annual values and therefore a rescaled range of monthly flows was made and range diagrams were provided. The effects of cycles and the slopes of spectral diagrams gave the other estimates of H. H provided a critical factor in determining the best type of model with predictability of river flows decreasing as H increased. (Kriss-Cornell)
W71-04770

THE FINITE DAM II,
Western Australia Univ., Nedlands.
For primary bibliographic entry see Field 08A.
W71-04771

DIGITAL COMPUTER SIMULATION OF WASTE TREATMENT PLANTS USING THE WATCRAP-PACER SYSTEM,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 07C.
W71-04772

INTRA-YEAR WATER STORAGE,
Arta (Greece).
For primary bibliographic entry see Field 04A.
W71-04773

MATHEMATICAL MODEL FOR WATER-WASTE WATER SYSTEMS,
Bechtel Corp., San Francisco, Calif. Scientific Development Dept.
For primary bibliographic entry see Field 05D.
W71-04774

MATHEMATICAL MODEL FOR WATER DISTRIBUTION SYSTEMS,
Arya Mehr Industrial Univ., Tehran (Iran).
For primary bibliographic entry see Field 08B.
W71-04775

WATER REUSE SYSTEMS ANALYSIS,
Institute for Water Resources (Army), Alexandria, Va.; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-04778

ECOLOGICAL MODELING RESEARCH IN THE GREAT LAKES,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries; and Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
James T. McFadden, and John M. Armstrong.
Shore and Beach, Vol 38, No 2, p 17-25, October 1970. 9 p, 6 fig, 1 tab.

Descriptors: *Systems analysis, *Mathematical models, *Ecology, *Great Lakes, *Water resources development, Decision making, Planning.
Identifiers: *Socio-economic problems, *Grand Traverse Bay.

The University of Michigan's Sea Grant Institutional Support Program, a multidisciplinary program begun in July 1969, was described as an experiment in the mobilization of resources of an educational institution to deal more effectively with current societal-environmental problems. Using a systems approach, the exploration of resource development alternatives was carried out through manipulation of predictive models of the marine resource system and the directly interlocking portion of the socio-economic system. Eight integrative functions were used to deal comprehensively with the problems and opportunities arising from the six major resource attributes of the Great Lakes: lake levels; water quality and circulation; plants and animals produced; size, depth and minerals of basin; unique character and configuration of shoreline; and regional, climate. In order to approach this long-term resource-planning objective, the Grand Traverse Bay was selected as the focus of pilot efforts to develop a complete model of a small part of the Great Lakes ecosystem. The predictive model was developed through a set of 'specific process sub-models' which generated the interactions or transfer process among the components of the system and interfaced with one another in a complex pattern. To provide data needed to develop these models, twelve field research projects were initiated. (Kriss-Cornell)
W71-04780

MARINE RESOURCES PLANNING AND MANAGEMENT FOR NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK,
Nassau and Suffolk Counties, N.Y.
Phillip B. Cheney, and Robert H. Ellis.
Marine Technology Society, Journal, Vol 4, No 2, p 50-55, March-April 1970.

Descriptors: *Water Resources, *Environment, *Planning, *Management, Coasts.
Identifiers: Long Island.

A joint project for the research and development of a system for marine environment and resources management of Long Island has been undertaken by Nassau and Suffolk Counties. The first phase of the program is discussed and the marine environment related problems of Long Island are considered. (Ensign-PAI)
W71-04837

6B. Evaluation Process

A WILD AND SCENIC RIVERS SYMPOSIUM.
Idaho Univ., Moscow. Water Resources Research Inst.

Available from NTIS as PB-197 527, $3.00 in paper copy, $0.95 in microfiche. Herbst, John R. and Michalson, Edgar L., editor. Idaho University Water Resources Research Institute Information Bulletin No 6, August 1970. 41 p, append. OWRR Project No B-014-IDA (1).

Descriptors: *Wild rivers, *Natural streams, *Natural resources, *Water resources, *Idaho, Aesthetics, Scenery, Preservation, Wild River Act, Water policy, Surface waters, Planning, Water utilization, Wildlife conservation, Fish conservation, Water control, Conferences.
Identifiers: *Wild and scenic Rivers symposium (Idaho).

This paper discusses the viewpoints of people of varied backgrounds and interests on the subject of wild and scenic rivers as expressed at the Wild and Scenic Rivers Symposium held at Salmon River Lodge, Idaho, July 25-27, 1969. The discussion covers most of the main points of wild rivers, from the plea to save some rivers for posterity to the developmental opportunities that rivers afford. Several conclusions were drawn from the Symposium. First, the 'Wild and Scenic Rivers Act' enacted by Congress is not a water project development act, but because there is some question as to development opportunities it was suggested that benefits foregone should be measured. A method to indicate the importance of aesthetic values should be developed, and the problem of identifying aesthetics needs resolved. Emphasis should be placed on alternative methods of wild and scenic river evaluation. This is a broader problem than just economics or engineering. Education of the public in terms of wild and scenic rivers is needed, as well as providing means for the public to express their preferences. (See also W71-04420) (Woodard-USGS)
W71-04419

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS,
Idaho Univ., Moscow. Water Resources Research Inst.
Fred J. Watts.
Water for Municipal and Industrial Use Subproject, Report, Water Resources Research Institute, Aug, 1970. 39 p, 19 tab, 4 ref, 1 fig. OWRR Project B-014-IDA (2).

Descriptors: *Wild rivers, Municipal water, Industrial water, Economic prediction, Idaho.
Identifiers: Public Law 90-542, Salmon River, Idaho Economic Base Study for Water Requirements, National Wild and Scenic Rivers System.

The Scenic Rivers Study Unit of the Water Resources Research Institute at the University of Idaho is attempting to identify valid criteria for evaluating rivers for wild or scenic classification. By studying the economic, aesthetic, scenic and other values of the Salmon River in Idaho, the study unit hopes to establish a methodology for planning the selection, use and management of wild and scenic river systems. The study of the Salmon River has been divided into eleven subprojects, each related to one of the resource or service functions of the river. This subproject on the municipal and industrial uses of the Salmon River attempted to catalogue this information for the present as well as future employment and population conditions up until the year 2020. (See also W71-04419) (Holmes-Rutgers)
W71-04420

IMPACT OF IRRIGATION DEVELOPMENT ON INCOME AND TRADE, EASTERN AND CENTRAL SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Economics.
For primary bibliographic entry see Field 03F.
W71-04421

THE SUSQUEHANNA COMMUNICATION-PARTICIPATION STUDY: SELECTED APPROACHES TO PUBLIC INVOLVEMENT IN WATER RESOURCES PLANNING,
Institute for Water Resources (Army), Alexandria, Va.; and Michigan Univ., Ann Arbor.
Thomas E. Borton, Katharine P. Warner, and J. William Wenrich.
IWR Report 70-6, Dec 1970. 128 p, 44 ref.

Descriptors: *Planning, *Community development, *Urbanization, *Institutions, Social aspects, Social values.
Identifiers: *Public participation, Citizen involvement in planning, Survey questionnaires, Community planning.

This research was conducted by the Environmental Simulation Laboratory and the Institute for Social Research of the University of Michigan. The study represents an effort to introduce and evaluate selected approaches to public involvement in the Susquehanna River Basin Study. The public involvement activities centered upon establishing a program of lined contacts between agency planners and local residents. Some of the important activities were identification and interviews with local opinion leaders, mailing of brochures, newsletters, and surveys, and workshops and forum meetings. Questionnaires were used throughout the study to evaluate changes in attitudes and the effectiveness of the techniques used. The findings indicate that the workshops were particularly successful in improving the understanding of attitudes and objectives between the agency planners and local representatives. The research evolved a public participation process model indicating the relation of public involvement to the phases of planning. (See also W71-04424)
W71-04423

PUBLIC PARTICIPATION IN WATER RESOURCES PLANNING,
Institute for Water Resources (Army), Alexandria, Va.
A. Bruce Bishop.
IWR Report 70-7, Dec 1970. 109 p, 27 ref.

Descriptors: *Planning, *Community development, *Urbanization, *Institutions, Social aspects, Social values, Social change.
Identifiers: Public participation, Planning methodology, Community planning, Decision-making.

Public concern over the use of the nation's natural resources has led to increased citizen participation in the public works planning process. This report focuses on the development of water resources in relation to the role of the planner in communicating and interacting with the publics in planning. It describes the institutional and behavioral aspects of planning as a process of social change, offers a descriptive model of the planning process, and with this as a framework discusses methods and approaches for developing public participation in planning studies. Six public participation program objectives are set forth to guide the organization of citizen involvement in planning studies. Initially, the planners should identify concerned local interests and establish working relationships with them in order to legitimize the study. A number of methods for working with the public are descrit including information campaigns, sample surv group advocacy, informal contact with local terests, community workshops, citizens' com tees, special task forces, public inquiries, public hearings. The use of a factor profile discussed as a method for presenting, discus and evaluating the social, environmental and c munity effects, together with the economic eff of alternative planning proposals. (See also W 04423)
W71-04424

REGIONALIZATION IN THE CONTEXT MULTIOBJECTIVE PLANNING AND EVALU TION,
Institute for Water Resources (Army), Alexand Va.
L. G. Antle, and R. J. Struyk.
Center for Economic Studies, Paper 70-2, Octo 1970. 17 p.

Descriptors: *Regional analysis, *Cost-ben analysis, *Decision making, *Economic justif tion, Feasibility, Social aspects.

This paper comments on the July 1970 draf 'Procedures for Evaluation of Water and Rela Land Resources Projects', the new multiple-ob tive planning process which is under considera by the Water Resources Council. The paper cepts the basic philosophy of the new procedu but points up certain problems especially conce ing the choice of regions to display informat required under the new procedures. In particula is necessary that off setting impacts not be c cealed, so that area affected differently should be consolidated into one region. This is import for secondary as well as primary benefits. T authors comment upon action of the office of B ness Economics, Department of Commerce (OB which is preparing estimates of economic impa by region for this and other purposes. Differen in defining planning regions for natural resou programs and for urban-oriented programs is p ticularly important. The OBE regions will be ba upon city regions each with its hinterland. As fa possible Standard Metropolitan Statistical ar (SMSA) are to be used. The authors point out t the analytical purposes of the OBE regions often not correspond to the 'project regions' o the 'displacement regions' within which influen such as project employment and project visitat are important. Formal defining of displacement gions is an important step, which however is not far required under the proposed new procedu (Whipple-Rutgers)
W71-04447

DISCUSSION OF DRAFT REPO PROCEDURES FOR EVALUATION OF WAT AND RELATED LAND RESOURCES PR JECTS,
New York State Dept. of Conservation, Alba Div. of Water Resources.
Nicholas L. Barbarossa.
Presented at third Annual Conference of Fede and State Officials, Salt Lake City, June 24, 19 11 p.

Descriptors: *Cost-benefit analysis, *Decisi making, *Social aspects, *Environment, Benef Direct benefits, Economic efficiency, Econon justification, Feasibility, Natural resources, Val National income, Regional analysis.

This is a critique of a 1969 draft of the new Wa Resources Councils proposals for multiple obj tive planning. The new principles propose that tional income, instead of being the prime objecti as previously, shall be only one of four objectives which three deal with social, environmental and gional objectives. The author objects strongly these proposed new principles because in his vi the change is still insufficient. He would burn t bridge to the past and abandon the benefit cost a proach altogether. He considers that national

e should not be a stated objective, and should eplaced by a general objective 'to develop the promising water resources projects at least o serve the many needs of the people.' Among views of the author, he opposes the opportu- cost approach to government discount rate culous'), and the view that secondary benefits d be ignored because they will generally can- it ('academic hash'). He considers that secon- benefits would be very much greater in the eastern United States than in other regions. pple-Rutgers)
04448

EVALUATION OF METHODS USED IN UATING RECREATIONAL BENEFITS OF TIPLE-PURPOSE WATER RESOURCE ECTS,
t Hinote.
ation Economics Branch, Division of Naviga- Development, Tennessee Valley Authority, ille, Tennessee, August, 1967. 81 p.

ptors: *Outdoor recreation, *Economic tion, *Benefits, *Costs, Prices, Demand, In- Economic efficiency, Data acquisition, resource development, Management, Deci- aking, Multiple-purpose projects, Supply.
iers: *Market value, *Consumer's surplus, added, Alternative costs, Travel costs.

paper the author reviews and summarizes orts that have been made to determine the ional benefits from multiple-purpose water ce projects in order to provide a means of social choice. Water has traditionally been as a free good and only recently has a value ttached. It has become necessary to establish ion of value and to measure the resource in- outdoor recreation by that criterion. The ommonly used method of evaluation of the ional benefits of public projects has been rket value method. Due to the weaknesses d, however, a number of other approaches nsidered. These include evaluation of the r net expenditures for recreation, the in- mpact of recreation on productive efficien- costs of recreational facilities, and the de- curve for recreation activities. The author les that the use of the imputed recreation curves is most promising but research is on (1) the factors effecting demand, (2) problems involved, (3) the substitution of osts for price, (4) exactly who receives the , (5) the impact of the supply of recrea- pportunities, and (6) the impact of particu- nagement plans upon project benefits. y-Rutgers)
449

MIC AND ADMINISTRATIVE EMS OF WATER POLLUTION,
State Univ., Corvallis.
. Castle.
culture and the Quality of Our Environ- Norwood, Massachusetts, The Plimpton 251-265, 1967.

ors: *Water quality, *Economic evalua- ecreation, *Water pollution, Management, isposal, Marginal costs, Decision-making, rivers, Government, Cost-benefit analysis, ment, Investment.
rs: *Externalities, *Economies of scale, narket values, *Market failure, Jaquina regon.

l interdependence in production and con- processes creates a situation in which the water quality cannot be determined by the The author finds that the least costly of achieving a given level of water quality group action. As an aid to this group deci- ing, economic evaluation studies are ex- useful. The paper reports on a study of the part of Oregon surrounding the estuary of na River. It was found that the tools exist for quantifying recreational and secondary benefits and that sequential process analysis is largely inadequate for making long-run economic projections. The author states that, if adequate institutional arrangements could be developed, communities or regions could have considerably more flexibility in the allocation of both the costs and benefits of water quality. (Murphy-Rutgers)
W71-04450

ECONOMIC GROWTH AND ENVIRONMENTAL COSTS,
Coe Coll., Cedar Rapids, Iowa.
John K. Chapman.
In: Man and the Quality of His Environment, Boulder, University of Colorado Press, 1968, p 231-239.

Descriptors: *Economics, *Environmental quality, *Water pollution, *Air pollution, Prices, Costs, Planning, Diseconomics of scale, Income, Population, Sewerage, Input-output, Regional analysis.
Identifiers: *Economic growth, *Boulder Colorado, Externalities, Multiplier effect.

This paper presents a study of the Boulder, Colorado economy in order to point out how economic growth can create environmental problems. The major purpose of this study was to utilize input-output analysis to trace the total income and employment effects of federally funded space research and production spending by several local establishments. However, the author uses this study to analyze the problem of the external diseconomics of scale which accrue to agglomerates of people with particular attention paid to the problems of air and water pollution. The difficulties arise because both the direct and indirect effects of pollution occur outside the market system. The author separates the costs into accommodation costs which arise out of the need to accommodate more people with higher incomes and removal costs which are costs arising out of air and water pollution. In conclusion, the author sees the need for a much larger effort in this type of analysis than is presently being made. (Murphy-Rutgers)
W71-04451

THE EXPOST EVALUATION OF FEDERAL WATER RESOURCE PROJECTS IN THE UNITED STATES,
Department of the Army, Washington, D.C.
Jim J. Tozzi.
Organization for Economic Cooperation and Development Seminar on Expost Evaluation, the Hague, Netherlands, October, 1970. 18 p.

Descriptors: *Economic evaluation, *Cost-benefit analysis, Flood control, Income, Taxes, Government, Multi-purpose projects, Recreation, Social aspects, Navigation, Costs, Transportation, Planning.
Identifiers: *Expost evaluation, *Corps of Engineers, Income redistribution, Dewey Reservoir, Arkansas River.

Expost evaluation of water resource projects refers to the assessment of their observed effects on the natural, economic and social environment. Relying upon the experience of the United States Army Corps of Engineers the author attempts to present the technique of expost evaluations and discusses the merits of this approach. The paper also identifies and explains some of the basic analytical principles involved in expost evaluation and gives specific examples of their application in water resource projects. The discussion includes the national income and income redistribution effects of water investments. The author concludes that post-construction evaluations are no less feasible than the usual pre-construction evaluations. (Murphy-Rutgers)
W71-04452

EVALUATION METHODOLOGY OF URBAN AND REGIONAL PLANS: A REVIEW,
London Univ. (England). School of Environmental Studies.
Nathaniel Lichfield.
Regional Studies, Vol 4, No 2, p 151-165, August 1970.

Descriptors: *Cost-benefit analysis, *Economic evaluation, Decision making, Linear programming, Feasibility, Systems analysis.
Identifiers: *Planning Balance Sheet, *Project appraisal, Cost effectiveness, Externalities, Public sector investment, Objective function, Net benefit.

The article makes a review of methods currently used or proposed for evaluation of prospective projects. The author feels evaluation methodology should satisfy certain criteria, such as complying with stated objectives, considering all costs including externalities and all benefits in money terms and finally indicating the incidence of costs and benefits on all parts of the community. The main methodologies studied are the Planning Balance Sheet, investment appraisal, cost minimization, cost effectiveness, and cost-benefit analysis. In cost minimization, the end product is assumed constant while in cost effectiveness, the end product is variable. Linear programming is considered under cost benefit techniques. The author finds that where a cost-benefit analysis is carried out in a comprehensive manner in relation to the systems and sectors of interest, this analysis becomes a Planning Balance Sheet. Of the methods considered, only cost benefit analysis fulfils the outlined criteria and is sufficiently comprehensive. This article is relevant for water research efforts interested in comparing alternative project evaluation techniques. (Siegenthaler-Rutgers)
W71-04453

POLICY MATTERS IN INVESTMENT DECISION-MAKING,
International Bank for Reconstruction and Development, Washington, D.C.
S. A. McBride.
Regional Studies, Vol 4, No 4, p 241-253, August 1970.

Descriptors: *Cost-benefit analysis, Decision-making, Economic evaluation, Interest rate, Economic efficiency, Systems analysis, Welfare economics, Budget constraint.
Identifiers: *Multiple objective function, Net benefit, Income redistribution, Opportunity cost, Externalities.

This paper proposes a benefit-cost framework that simultaneously treats multiple objectives, as well as other matters of policy. The author attempts to illustrate the importance of policy determination in investment decision-making. The framework provides an estimate of the first round net benefits generated by the investment for multiple objectives. To simultaneously treat the objectives of economic efficiency and income redistribution, the objective function is formulated by weighting the net contribution that projects make to each objective subject to constraints. It is shown that the outcome depends largely on the policy-makers statement of objectives, the relative values assigned to the contributions to these objectives generated by the investment and the selection of an interest rate and economic life of the project. The model does not consider the multiplier incomes generated from increased spreading by beneficiaries of the project. This article is relevant for possible application to multipurpose project evaluation. (Siegenthaler-Rutgers)
W71-04454

TECHNIQUES FOR PROJECT APPRAISAL UNDER UNCERTAINTY,
International Bank for Reconstruction and Development, Washington, D.C.
Shlomo Reutlinger.
World Bank Staff Occasional Papers, Number 10, 1970. 95 p.

Descriptors: *Cost-benefit analysis, *Uncertainty, Probability, Correlation analysis, Decision making, Risk, Feasibility, Economic evaluation.
Identifiers: *Project appraisal, *Aggregation problem, Bias, Standard deviation, Public investment, Sensitivity analysis, Rate of return, Present value, Maximum likelihood.

The primary purpose of this study is to present a feasible method for evaluating the riskiness of investment projects. A second objective is to show how quantitative evaluations of the riskiness of projects might be used in various decision problems. The emphasis is on methodology and problems of measurement. The paper recommends that the best available judgments about the factors affecting cost and benefit estimates of a project can be estimated via probability distributions. These distributions can be aggregated mathematically to yield a probability distribution of the rate of return, or net present worth of the project. The author discusses the nature of uncertainty and the kind of judgments that are basic ingredients for decision-making. He singles out the probabilistic approach as most suitable for project appraisal. The paper considers the aggregation of probability distributions of relevant factors and parameters into a probability distributions of the economic returns of a project. Case studies are used to illustrate the application of the method. This paper is relevant for the evaluation of water resource projects which have identifiable risks associated with either cost and/or benefit projections. (Siegenthaler-Rutgers)
W71-04456

COST-BENEFIT ANALYSIS AND THE THEORY OF PUBLIC FINANCE,
Harvard Univ., Cambridge, Mass.
Richard A. Musgrave.
Journal of Economic Literature, Vol VII, No 3, p 797-806, September 1969.

Descriptors: *Cost-benefit analysis, *Economic evaluation, *Welfare economics, Financing, Investment, Decision-making, Planning, Management, Economic efficiency, Optimization, Government, Income, Rate of discount, Taxes.
Identifiers: *Public finance, *Social goods, *Opportunity cost, Distributional objectives.

This paper is concerned with the application of cost-benefit analysis to the determination of public expenditure policy and its relation to the central economic theory of social goods. It is argued that cost-benefit analysis can perform most effectively in the case of an intermediate social good. The author examines the relation between investment mix and total investment and the way in which the means of finance enter the profitability calculation. On the problem of distributional objectives, the author argues against the inclusion of value weights into the objective function for the particular investment and instead favors a policy which combines various instruments to secure various targets. The author concludes that cost-benefit analysis, even if combined with traditional tax analysis does not provide a substitute theory of public finance. Because of the clarification of the principles behind cost-benefit analysis and the public good aspects of water resources, this article is relevant to the water researcher. (Murphy-Rutgers)
W71-04461

TECHNOLOGICAL INJURY,
Blackburn Coll. of Technology and Design (England).
For primary bibliographic entry see Field 06G.
W71-04465

WATER POLLUTION,
Mersey and Weaver River Authority (England).
C. Lumb.
In: Technological Injury, New York, Gordon and Breach, 1969, p 29-51.

Descriptors: *Pollution, *Water resources, *Technology, Water supply, Water quality, Water demand, Rivers, Effluents, Sewage, Waste water, Pesticides, Water law, Oxygen.
Identifiers: *Oil contamination, Synthetic detergents.

This paper reviews the adverse effects which technological developments have had on the pollution of water and water supplies. The principle uses made of water resources are of two types: (1) abstractions from sources of supply for domestic, manufacturing, cooling and irrigation purposes; and (2) uses in site for fisheries, navigation, and recreation purposes and for the conveyance of waste effluents. After summarizing these uses the author examines some of the ways in which these may be threatened by technological developments. There is a discussion of pollution by sewage effluents, by the chemical industries, by oil refining, by metal finishing industries, by agriculture, by pesticides, and by radioactivity. For each type of pollution, the economic, social, and technological magnitude of the problem is outlined. The need for controlling pollution is discussed and the legal position of pollution control in Great Britain summarized. This article has relevant extensions to pollution problems in the United States. (See also W71-04465) (Murphy-Rutgers)
W71-04466

PROBLEMS IN IMPLEMENTING PROGRAM BUDGETING,
California Univ., Los Angeles.
George A. Steiner.
In: Program Budgeting, edited by Novick, David, Cambridge, Harvard University Press, 1967, p 308-352.

Descriptors: *Budgets, *Management, *Decision-making, *Government, Cost-benefit analysis, Social aspects, Planning, Political aspects, Pollution, Resource allocation, Time.
Identifiers: *Program budgeting, *Relevant alternatives, National Environmental Health Center, Magerial discretion.

This study examines the many impediments to the rapid expansion of program budgeting and long-range planning in the analysis of government projects. Program budgeting is a useful tool in water resource projects and the author's treatment of these problems should be of interest to the water researcher. The program budgeting concept is outlined and a brief history of its use is presented. Of particular interest to the water researcher is the case study of the National Environmental Health Center which was designed to study air, water and land pollution. The growing recognition of the benefits of the program-budgeting system has resulted in its adaptation in many government agencies. The system permits more rational decisions and better management by fostering a more complete analysis of alternative investment proposals. (Murphy-Rutgers)
W71-04467

PROGRAM BUDGETING--APPLYING ECONOMIC ANALYSIS TO GOVERNMENT EXPENDITURE DECISIONS,
Washington Univ., St. Louis, Mo.
Murray L. Weidenbaum.
In: Planning-Programming-Budgeting--A Systems Approach to Management, Chicago, Markham Publishing, p 165-180, 1967.

Descriptors: *Program budgeting, Decision-making, Cost-benefit analysis, Economic evaluation, Resource allocation, Discount rate, Economic efficiency, Systems analysis.
Identifiers: *Planning-Programming-Budgeting, Government expenditures, Cost effectiveness analysis, Externalities.

This paper evaluates the trend toward the application of economic analysis to public sector decision-making. Antecedents of Planning-Programming-Budgeting (PPB) are discussed to provide the groundwork for an evaluation. The use of cost-benefit analysis by Federal agencies to rank a compare prospective projects demonstrates the of objective economic analysis to narrow the ar in which political forces may operate. T Planning-Programming-Budgeting-System (PP is a combined planning and budgeting proc where national goals are reduced to specific gram operations and the most economical meth of executing these objectives is identified. Th steps are required in the PPB system; namely, identification of national goals, the relation broad goals to specific alternative programs the translation of the resource inputs into bud dollars. The author finds the long term impact PPB to be beneficial as there is less reliance on s jective judgment with information on the econo returns of the respective programs. This articl relevant for water administrators concerned w the application of PPB to water resource progra (Siegenthaler-Rutgers)
W71-04468

SYSTEMS ANALYSIS TECHNIQUES F PLANNING-PROGRAMMING-BUDGETING,
Rand Corp., Santa Monica, Calif.
E. S. Quade.
In: Planning-Programming-Budgeting: A Syste Approach to Management, Chicago, Markh Publishing, 1967, p 292-312.

Descriptors: *Systems analysis, Decision-maki Linear programming, Operation research, Unc tainty, Economic efficiency, Queueing theory.
Identifiers: *Planning-Programming-Budgeti Objective function, Cost-effectiveness analysis.

Systems analysis is an analytic study designed help a decision-maker identify a preferred cho among possible alternatives. The possible appli tion of the systems analysis to Planning-P gramming-Budgeting (PPB) is considered. T systems analysis method constructs and opera within an abstraction of the actual problem. T analysis process first considers the decision-mak objectives, then alternative strategies, and th respective costs. The model estimates for each ternative the costs that would be incurred and extent to which the objectives would be attained criteria weighs costs against performance and ranges the alternatives in order of preference. T uniqueness of the method is the emphasis on whole problem, the use of uncertainty and quant cation using mathematical models all based scientific methods. The article is relevant for wa administratorsconcerned with decision-maki models to apply to project evaluati (Siegenthaler-Rutgers)
W71-04469

PUBLIC EXPENDITURE BUDGETING,
Michigan Univ., Ann Arbor.
Peter O. Steiner.
Washington, The Brookings Institution, 1969. 1 p.

Descriptors: *Budgeting, *Decision-making, Co benefit analysis, Resource allocation, Welfa economics, Discount rate, Economic efficien Constraint.
Identifiers: *Public expenditure, *Public intere Externalities, Transaction costs, Public good, O jective function, Opportunity cost.

The author considers the political-econom process of reaching and implementing public e penditure decisions. The theory of public expen ture is considered as two different proposition namely, the theory of marginal public expenditu and the theory of the public interest. The public terest discussion is concerned with the manner which demands for public activity are articulat and legitimized. Although alternative views on t nature of the public interest reveal no consensu the author stresses that collective social priorit can be inferred from past social actions and c serve as a guide to public decision-making. To a ticulate the public interest, a multi-dimensional o

e function is preferable to a single dimen-
one stressing efficiency in order to avoid bias
valuation of intangibles. Marginal public ex-
ture theory is concerned with how the deci-
naker chooses among competing demands
constraints. Cost-benefit analysis is relevant
or project selection and public decision-mak-
ut the author advocates better measurements
efits and costs rather than conceptualization.
ook is relevant for water resource planners
rned with the economic evaluation of
ctive water projects. (Siegenthaler-Rutgers)
04470

RAM BUDGETING AND BENEFIT-COST
YSIS.
nd Univ., College Park; and Management
is Center, Inc., Washington, D.C.

H. Hinrichs, and Graeme M. Taylor (edi-
Pacific Palisades, California: Goodyear
ing Company, 1969. 420 p.

tors: *Program budgeting, *Cost-benefit
s, Decision-making, Risk, Resource alloca-
Systems analysis, Economic evaluation,
nt rate, Interest rate.
ers: *Capital budgeting, *Public expendi-
xternalities, Objective function, Planning-
mming-Budgeting, Cost-effectiveness.

ok is a series of essays designed to present a
sequence for understanding cost-benefit
. It begins by stating the rationale for cost-
analysis and provides a comprehensive
of benefit-cost theory. Readings and cases
sented to illustrate the concept of a program
the design of program structure, deter-
n of objectives, criteria and output mea-
An extensive treatment of program analysis
nted with essays on capital budgeting, deci-
les, externalities, multiple objectives, risk
inty, and systems analysis. Fifteen case stu-
e included concerned with government
s and the use of program budgeting. In the
t of the book, the issue of multipurpose
systems is discussed as well as the possible
l misuses of analysis. This book is relevant
er resource planners concerned with a
approach to program evaluation. (See also
472 thru W71-04475) (Siegenthaler-Rut-

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NMENT DECISION-MAKING AND THE
Y OF BENEFIT-COST ANALYSIS: A
R,
d Univ., College Park.
I. Hinrichs.
ram Budgeting and Benefit-Cost Analysis,
969.

ors: *Decision-making, Optimization,
efit analysis, Resource allocation, Risk,
rate, Budget constraint, Political con-
ocial welfare, Probability.
rs: *Cost-effectiveness, *Objective func-
xternalities, Pareto optimality, Feedback,
prices, Internal rate of return, Time
ce, Opportunity cost.

le gives a step by step description of cost-
nalysis along with applications to govern-
ision-making. Important to this method is
ment of the problem or specifying ends or
and the measurement of these benefits in
rms. Next, costs must be specified and
in monetary terms. In setting objectives
he author cites possible pitfalls such as the
of means as ends and the exclusion of
ifiable variables in decision-making. Once
tive function is known, the next step is to
the physical, legal, distributional, budget
ical constraints connected with resource
The question of externalities is discussed
th the potential repercussions that can
en the indirect effects of decision-making are not considered. Once the decision-maker has specified and quantified his benefits and costs, allowing for difference in time through the interest rate, he must allow for uncertainty through various adjustments to simulate a real world situation. This primer provides a brief overview for water resource planners concerned with decision-making and program evaluation. (See also W71-04471) (Siegenthaler-Rutgers)
W71-04472

MULTIPURPOSE BUDGET SYSTEMS,
Brookings Institution, Washington, D.C.
Allen Schick.
In: Program Budgeting and Benefit-Cost Analysis, p 358-372, 1969.

Descriptors: *Multi-purpose budgeting, *Resource allocation, Economic evaluation, Decision-making.
Identifiers: *Planning-Programming-Budgeting, Crosswalking imperfect integration.

Planning-Programming-Budgeting (PPB) integrates the three core functions of budgeting, control, management, and planning into the budget process. Under PPB, government agencies have to reconcile program accounts with the existing appropriations structure resulting in a 'crosswalk problem'. The Crosswalk problems occur because of the disparity between the classification in the program structure and appropriations and is one aspect of the broader problem of a multipurpose budget system. The success of PPB is contingent on the development of a system that transfers control and management to lower levels and elevates planning. The author suggests that although incompatibilities do exist in a multi-purpose budget strategy, it is possible to integrate the functions through changes in the definitions of roles, improved allocation of budgetary functions and better data utilization. Although integration is cited as a solution, it must be imperfect and gradual in order to develop the optimum level with experimentation and practice. This article is relevant for water administrators concerned with budgetary decision processes. (See also W71-04471) (Siegenthaler-Rutgers)
W71-04473

SURVEY OF USE BY FEDERAL AGENCIES OF THE DISCOUNTING TECHNIQUE IN EVALUATING FUTURE PROGRAMS,
Comptroller General of the United States, Washington, D.C.
Elmer Staats.
In: Program Budgeting and Benefit-Cost Analysis, p 212-228, 1969.

Descriptors: *Economic evaluation, *Cost-benefit analysis, Discounting, Present value, Cost, Water resource development, Resource allocation, Interest rate.
Identifiers: *Implicit discount rate, Explicit discount rate, Opportunity cost, Rate of return.

This article discusses a survey made by the General Accounting office concerning the use of discounting by federal agencies in evaluating future programs. The theory underlying the discounting technique is that calculation of the present values through discounting makes possible a comparison of costs and benefits. These comparisons aid in program evaluation and in the choice between alternative programs. The distinction between implicit and explicit discount rates is cited. The results of the survey indicate a majority of the agencies in the study are planning to use discounting in decision-making. A divergence of opinion on discounting is reflected in agency practices. Differences to exist in that some agencies do not use discounting with the result that decision-making may result in resource misallocation. In conclusion, the author stresses the need for greater standardization in discounting techniques to enhance the quality of decision-making. This article provides a useful background of current Federal discounting policies and should be of general interest for the evaluation of public water investment projects. (See also W71-04471) (Siegenthaler-Rutgers)
W71-04474

THE SYSTEMS ANALYSIS APPROACH,
Department of Defense, Washington, D.C.
Alain C. Enthoven.
In: Program Budgeting and Benefit-Cost Analysis, p 159-168, 1969.

Descriptors: *Systems analysis, Decision-making, Risk, Cost-benefit analysis, Resource allocation, Budgeting, Social welfare, Simulation, Feasibility.
Identifiers: *Planning-Programming-Budgeting, Cost-effectiveness, Bias.

The systems analysis approach to problems is to examine an objective in its broadest aspects and develop for the decision-maker information that will aid him to select the efficient method. The selection process requires the identification of alternative ways of achieving the objective and then the estimation of the benefits and the costs of each alternative. The author states the method tries to identify the alternative that yields the greatest effectiveness at the least cost. Limitations of systems analysis include overemphasis on quanitative analysis, a confusion of performance with effectiveness, and a bias toward new approaches in favor of old ones. A discussion of the application of systems analysis to the Defense Department is given with the contribution of the method to the decision-making process stressed. The author stresses that the method can be applied to social problems as well and is important in the design and development of alternative approaches of program development. This article is relevant for water studies concerned with the application of budgeting methods to water resource planning. (See also W71-04471) (Siegenthaler-Rutgers)
W71-04475

PUBLIC EXPENDITURES AND POLICY ANALYSIS.
Grinnell Coll., Iowa; and Pennsylvania Univ., Philadelphia.

Robert H. Haveman, and Julius Margolis (editors). Chicago, Markham Publishing Co., 1970. 596 p.

Descriptors: *Economic evaluation, *Government, *Budgets, *Planning, Risk, Spillover, Income, Cost-benefit analysis, Water pollution, Rate of discount, Prices, Natural resource development, Project planning, Social aspects, Water law.
Identifiers: *Public expenditure analysis, *Institutions, Programming, Externalities, Income distribution, Unemployment, Shadow prices, Collective action.

The papers presented in this volume are intended to survey the theory of public expenditure analysis and evaluate federal government practices in choosing among investment alternatives. This volume should be of particular interest to the economist concerned with improving the efficiency of government decision making in the area of water resource development. In the first section of the book the papers are devoted to exploring the economic basis for public expenditures and other governmental action. Particular attention is paid to the problems of market failure, income distribution and the appropriate economic functions of government. The second section deals with the institutional arrangements which affect the ability of the federal government to implement efficient public expenditure policy. The following section analyzes some of the empirical problems encountered in estimating the benefits and costs of public expenditure alternatives. These include the rate of discount, the treatment of risk and uncertainty, and the effect of unemployed resources. The fourth section contains an evaluation of the Planning-Programming-Budgeting System and its component parts. The concluding section deals with unresolved issues and the next steps for policy analysis and program evaluation in selected functional

areas of the federal budget. (See also W71-04478 thr W71e04482) (Murphy-Rutgers)
W71-04477

THE PUBLIC SECTOR AND THE PUBLIC INTEREST,
Michigan Univ., Ann Arbor.
Peter O. Steiner.
In: Public Expenditures and Policy Analysis, 1970, p 21-58.

Descriptors: *Government, *Economic evaluation, Economic efficiency, Spillover, Decision-making, Discount rate, Costs, Environmental quality, Social aspects, Demand, Welfare economics.
Identifiers: *Public goods, *Market failure, Collective action, *Externalities, Multi-dimensional objective function, Utility, Social welfare, Willingness to pay.

The author attempts to establish a basis of collective concern and for the provision of public goods. This paper provedes and discusses the nature of a public good throug a number of examples. Of particular interest to the water researcher is the dicussion given to those public goods concerned with the quality of the environment. The theories of individual utility, willingness to pay, and aggregate social welfare are presented, along with their economic implications and their role as extramarket forces in the economy. Because noncomparability is a feature of many public choice problems the author stresses a multi-dimensional objective function, which explicitly considers conflicts among objectives, rather than one involving only economic efficiency. The concluding section cosiders how the political structure articulates social priorities and the extent to which the process itself determines the outcome. This paper is relevant to the water researcher interested in defining the proper role of government in water resources development. (See also W71-04477) (Murphy-Rutgers)
W71-04479

EVALUATING PUBLIC EXPENDITURES UNDER CONDITIONS OF UNEMPLOYMENT,
Grinnell Coll., Iowa.
Robert H. Haveman.
In: Public Expenditures and Policy Aanalysis, 1970, p 330-345.

Descriptors: *Income, *Costs, *Economic evaluation, Social aspects, Government, Resource allocation, Demand, Regional analysis, Cost-benefit analysis, Dams, Capital, Investment.
Identifiers: *Unemployment, *Monetary costs, *Real costs, Social costs, Social labor costs.

This paper attempts to improve the methods for evaluating the economic gains and the costs of alternative expenditure projects. It discusses the reasons why monetary costs fail to reflect real social costs when the economy is experiencing unemployment and excess capacity, and presents a method for adjusting monetary costs when such conditions prevail. The implementation of this method eliminates the overstatement of real costs by monetary costs when some of the resources drawn into use by a public expenditure have idleness as their alternative. This paper is of significance to cost-benefit analyses of water resource investments. (See also W71-04477) (Murphy-Rutgers)
W71-04480

SOCIAL RETURNS FROM PUBLIC TRANSPORT INVESTMENT: A CASE STUDY OF THE OHIO CANAL,
California Univ., Riverside.
Roger L. Ransom.
Journal of Political Economy, Vol 78, No 5, p 1041-1060, September-October 1970.

Descriptors: *Economic evaluation, Decision-making, Economic rent, Average cost, Linear programming, Economic efficiency.
Identifiers: *Transportation costs, *External benefits, Bias, Parameter, Constant costs.

Traditionally, the historical approach to canal development has been the study of the decision-making process which led states to undertake a canal project. This paper focuses on the Ohio Canal and estimates the external benefits accruing to the Ohio region as a measure of the contribution of the canal to Ohio's development. To indicate the external returns to the canal, the theory of economic rent is used. The author estimates the return from the Ohio Canal for six three year periods using as data the traffic in exports and imports to the region. The shipment data were adjusted so the pattern of least-cost shipments could be determined by linear programming. The estimates of return were based on current charges by commodity class. The results indicate from 1837-1850, returns from the canal were profitable; however, after 1850 with railroad competition, profits declined. The profitable returns demonstrate the impact of the canal on the development of the market in this region a factor which the railroads utilized. In conclusion the capital investment in the canal was repaid and for that period, the investment was efficient. This article offers a possible methodology to evaluate the impact of a water project on economic growth and development. (Siegenthaler-Rutgers)
W71-04483

HYDROGEOLOGICAL AND ENGINEERING GEOLOGICAL FACTORS IN REGIONAL SPATIAL PLANNING,
Institute for Geological and Geophysical Research, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 04C.
W71-04613

WATER RESOURCES DEVELOPMENT NEEDS IN THE SOUTHERN WATER RESOURCES CONFERENCE REGION,
Reuben J. Johnson.
Southern Water Resources Conference, 15th Meeting, Tulsa, July 16-18, 1969. Council of State Governments, Southern Office, Atlanta, nd p 39-44.

Descriptors: *Water resources development, *Water policy, *Water management (Applied), *Southeast U.S., Project purposes, Water utilization, Conservation, Water conservation, Recreation facilities, Interstate commissions, State governments, Local governments, Non-structural alternatives, Water supply, Water pollution control, Public utilities, Planning, Reservoirs, Government finance, Water allocation (Policy), Environment, Aesthetics, Sewage treatment, Personnel, Legislation.

Presented at the fifteenth meeting of the Southern Water Resources Conference, this speech presents an analysis of the sixteen areas most in need of serious investigation and prompt implementation. The speaker lists and discusses the need for: (1) flood plain management legislation; (2) regional resource framework studies--most needed in the South; (3) early selection and acquisition of reservoir sites to avoid rising prices; (4) preservation of wild river and greenbelt areas; (5) studies of thermal-electric plant sites to minimize pollution dangers; (6) review and revision of state water laws; (7) consideration of institutional arrangements, such as river basin commissions, to provide for regional planning and resource management; (8) water quality control criteria; (9) coordination of land management with water resource and recreational programs; (10) establishment of water use priorities; (11) consideration of regional water supply and sewage treatment facilities; (12) environmental quality studies; (13) erosion and sedimentation effects of construction methods; (14) aesthetic consideration in project planning; (15) development of financing sources; and (16) the training of personnel in all water resource fields. The speaker urges strong cooperation among all local, state, and federal agencies to implement the needed water resource development progr
(Liptak-Florida)
W71-04644

SOCIO-ECONOMIC STUDY OF MULTI USE WATER SUPPLY RESERVOIRS,
Stone (Ralph) and Co., Inc., Los Angeles Calif
Ralph Stone, and Helen Friedland.
Available from NTIS as PB-197 672, $6.0 paper copy, $0.95 in microfiche. Final Re January 2, 1971. 324 p, 118 tab, 51 fig, 74 OWRR Project C-1633 (3149) (1).

Descriptors: *Multiple-purpose reserv *Recreation, *Cost-benefit analysis, *Mathe cal models, *Water resources planning, Com models, Decision-making, Domestic w Drainage systems, Economic impact, Lakes, perty values, Regression analysis, Runoff, S values, Water pollution sources, Water qu Watersheds, Water sports, Water supply, W treatment, Evaluation, Costs analysis, W resources development, Census.
Identifiers: England/Wales system.

The purpose of the study was to determine th cial, economic, and health and safety impa selected recreational activities on, in, or nea terminal reservoir. A preliminary, or basic, benefit mathematical model was designed t clude consideration of these factors, and a re mended program for its extension and refine was developed. Analysis was made of the econ influence on surrounding land values of four p type reservoirs: closed, domestic supply recreational use only; multipurpose, no body tact sports; multipurpose, including body-co sports. For the three reservoirs permitting re tional use, the overall economic influenc recreational usage was estimated, and the avai data on reservoir water quality were analyze nationwide survey (48 States responding) was formed to determine policies and experience ing to recreational use of the domestic water su reservoir. Recommendations were developed coordinated, single-agency, river basin-orie water resource management suitable for na wide application based on the England/W system.
W71-04672

URBANIZATION WITHOUT MODERNI TION,
Kentucky Univ., Lexington.
Stephen R. Cain.
Available from NTIS as PB-197 675, $3.0 paper copy, $0.95 in microfiche. Water Reso Research Institute, Mimeographed, 1969. 15 ref. OWRR Project No A-022-KY (3).

Descriptors: *Urbanization, Community deve ment, Population, Urban sociology, Social char
Identifiers: *Regional development, Social syst

In certain regions of rural Kentucky the econ has traditionally been based on extractive, haustive, and consequently terminal industries was the case in Timber Town and in Oil Town, vice centers which have developed, diversified flourished in response to such economic supp have been unable to build the foundation neces to continue after the cessation of the indus stimulus. The declined population of Oil T began when the oil company stopped housing ployees; however, the decline increased drasti when jobs became scarce. The attraction government is demonstrated by the rapidity which Government Town overwhelmed the o settlements when it became the county seat. introduction of state and federal aid program the 1930's strengthened this attraction as the co ty government became the local administrator as state and federal representatives of governm programs established offices in the county sea rural Kentucky, government has been the most cessful support of multi service center, and county seat has consequently assumed institutio primacy. (Wray-Chicago)

W71-04676

PLANNED UTILIZATION OF GROUNDWATER BASINS: COASTAL PLAIN OF LOS ANGELES COUNTY,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 04B.
W71-04683

THE NUCLEAR POWER SCHEDULE STRUGGLE,
C. Olds.
Power Engineering, Vol 79, No 9, p 39-41, September 1970.

Descriptors: *Nuclear power plants, *Electric power plants, Electric power production, *Nuclear energy, Nuclear wastes, Thermal pollution, Prediction, Future planning, Economic prediction.

The future development of nuclear power electric energy production is projected for the next 7 years. It is expected that by 1975, 83 nuclear power plants will be put into operation with a total capacity of 60,600 Mwe. The problems connected with this nuclear power production growth are discussed. Stoppage seems to have increased during the past period in nuclear power plant schedules. The impact of recent emphasis on environmental problems on increasing power capabilities is noted to have contributed to what appears a power shortage for the next several years. (Vanderbilt)
W71-04722

ECONOMICS OF AIR AND WATER POLLUTION.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.

Available from NTIS as PB-195 424, $3.00 in paper copy, $0.95 in microfiche. Bulletin No 28, Water Resources Research Center, Edited by W. Walker, Oct 1969. 250 p.

Descriptors: *Cost-benefit analysis, *Economic justification, *Multiple purpose projects, *Third party effects, *Water pollution control, Benefits, Water supply.
Identifiers: *Effluent charges.

The work represents proceedings of a seminar conducted at Virginia Polytechnic Institute, on 'Economics of Air and Water Pollution', for the purpose of explaining some of the relevant economic principles to engineers and administrators. There were seventeen speakers, talks relevant to water pollution covered interdisciplinary approaches, externalities, public and private goods, proposals for subsidies or effluent charges for waste treatment, laws and regulations for control, cost benefit analysis, and public expenditures under conditions of unemployment. Generally similar coverage was given to air pollution problems. (See also W71-04740 thru W71-04743) (Whipple-Rutgers)
W71-04739

MARKET FAILURES - WHY EXTERNALITIES ARE NOT ACCOUNTED FOR IN THE MARKET,
Office of the Chief of Engineers (Army), Washington, D. C. Civil Works Directorate.
Schmid.
Economics of Air and Water Pollution, Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg, Va., p 29-36, Oct. 1969.

Descriptors: *Third part effects, *Resource allocation, Decision making, Institutions, Resource allocation, Public benefits, Economic efficiency.
Identifiers: *Externalities, Market mechanisms, Public goods.

Discusses public goods. Explains that environmental advantages have limits in capacity and therefore are not classic examples. Action to distribute external advantages require group decisions, public subsidy, tax measures, legal prohibitions, changes in property rights, public enterprise, or social pressure. If consumers want more natural environmental products they must be prepared to bid more, in terms of devoting more resources to this purpose. There is a point at which society must make a decision as to the cost of further improvement compared to the value of alternative investments. (See also W71-04739) (Whipple-Rutgers)
W71-04741

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1970.
National Water Commission, Washington, D. C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $0.30. Interim Report No 2, December 31, 1970. 41 p, 2 append.

Descriptors: *Planning, *Economics, *Environmental effects, *Social aspects, *Ecosystems, *Economic feasibility, Regional analysis, Resource allocation water pollution control decision making.
Identifiers: *Ecosystem response.

This is the second interim report of the National Water Commission. The first interim report outlined the organization for the task to be accomplished. At this time, only a few reports have been completed; therefore only a general idea of progress is available. Through the commissions staff, consultants, panels, and a number of contracts with universities and consulting firms, twenty-two special studies are underway. Studies are broadly classified as covering legal matters, engineering and environmental sciences, social and behavioral sciences, and forecasts. Studies of economic interest include the ecosystem's response to water manipulation, especially recycling, the value of water in its several uses, metropolitan problems including waste water management, market and administrative allocation as possible supplements to water law systems, the use of water resources to promote regional economic development, effects of water development on environment, critique of current methods of economic evaluation and a critical review of the U.S. program of water pollution control. (Whipple-Rutgers)
W71-04744

ECONOMIC INSTITUTIONS AS SOCIAL INDICATORS,
Kentucky Univ., Louisville.
Charles R. Smith.
Paper read in the Symposium 'Emerging County Subcultural Units in Kentucky,' American Society for Ethnohistory, Ithaca, NY, Oct 24, 1969. 14 p, 4 tab, 20 ref. OWRR Project A-022-KY (7).

Descriptors: *Planning, *Social change, Social aspect, Analytic techniques, Evaluation, *Institutions.
Identifiers: *Comprehensive planning, Social system, Interdisciplinary studies, Social system, Regional development.

Traditionally social scientists have worked in the analyzation of human behavior, and not prediction of behavior. However, in an age where technological innovations are rapidly diffused into diverse cultures and sub-cultures, the necessity of planning for implementation is increasing in order to minimize the conflict between innovation and the culture involved. Social indicators could provide planners with information additional to the sophisticated system of economic indicators which allows planners to measure in one way the overall state of the economy. This approach is intended to focus attention on human problems associated with technological innovations and to provide planners with information that might enable them to implement change with a minimum of conflict. A study was made of a rural county in Kentucky to establish a position on the modernization continuum for summer of 1969. The social indicators reveal that the county is moving toward the Gesellschaft pole on the modernization continuum because of an increase in immigrant and externally owned businesses, improved transportation, and difficulty for providing employment for youth. Social indicators can be used to assess the direction of a community to permit better planning. (Wray-Chicago)
W71-04746

METROPOLITAN PLANNING AREA, REGIONAL ANALYSIS.
Muskegon County Metropolitan Planning Commission, Mich.

Aug 1970. 15 p, 2 pl, 2 map.

Descriptors: *City planning, Community development, Planning, *Area Redevelopment, Michigan.
Identifiers: *Metropolitan areas, Urban environment, *Muskegon, Mich.

There are two general approaches to defining a conceptual framework for regions, the geographic and the sociological. The geographic approach serves mainly to describe existing conditions and provides only limited information on the origins of regional relationships. The concept is not very productive for planning and development applications. The sociological approach provides the necessary corrective to the geographic in its emphasis on a flexible definition. In order to be successful in meeting development objectives, regions must represent the reality of a dynamic social order. Muskegan, Michigan is described, including its economy, housing, community services, institutions, transportation, recreation, and communications. Regions for development should be identified based on the particular development purpose intended. Institutional frameworks should be sought which differentiate between policy generation, program review, and effectuation. Recommendations include flexible development regions, multiple efforts to identify development potential, and formation of the West Michigan Shoreline Regional Planning Commission. (Wray-Chicago)
W71-04747

REGIONAL ACTION: KEY TO THE FUTURE OF SAN FRANCISCO BAY/I,
California State Water Resources Control Board, Sacramento.
Priscilla Perlman.
Water and Wastes Engineering, Vol 7, No 5, p 45-47, May 1970. 2 fig.

Descriptors: Water quality control, *Programs, *Planning, *Water management, *Pollution abatement, California.
Identifiers: San Francisco.

The completion of the first phase of a program for the protection of water resources in California by the State Water Resources Control Board is presented. Objectives and principles have been set forth for a comprehensive study to develop a water quality management program for San Francisco Bay and the Sacramento-San Joaquin Delta of California. The program has taken over four years to research and has involved engineering firms, biologists, oceanographers, demographers, economists, private consultants and government agencies at a cost of almost three million dollars. (See also W71-04810). (Ensign-PAI)
W71-04809

REGIONAL ACTION: KEY TO THE FUTURE OF SAN FRANCISCO BAY/2,
California State Water Resources Control Board, Sacramento.
Priscilla Perlman.
Water and Wastes Engineering, New York, Vol 7, No 6, p 70-73, June 1970. 2 fig, 4 ref.

Descriptors: Water quality control, Programs, *Planning, *Water management, *Pollution abatement, California.

Identifiers: San Francisco.

In part 1 of this article, the objectives and principles of this study were set forth. This part deals with the proposals for developing a water quality management program. It was found that present conventional waste water treatment methods fail to a significant degree to remove both toxicants and biostimulants. An immediate solution to present water quality problems must be found and a firm basis for maximizing future use of the water resources must be provided. With these things in mind recommendations were made to the legislature and are itemized and stated in the article. Work is under way on several of the critical studies. (See also W71-04809). (Ensign-PAI)
W71-04810

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE SIMPLE ECONOMICS OF INCENTIVE CONTRACTING,
California Univ., Los Angeles.
J. J. McCall.
The American Economic Review, Vol LX, No 5, p 837-846, December 1970.

Descriptors: *Cost allocation, Risk, Economic efficiency, Probability.
Identifiers: *Incentive contracting, Fixed price contract, Target cost, Target profit.

This paper presents an economic analysis of three different kinds of government procurement contracts; namely, the fixed price contract, the fixed price incentive contract, and the cost plus fixed fee contract. From an analytical point of view, the fixed price and the cost plus fixed fee are special cases of the fixed price incentive contract. In the fixed price incentive contract, the firm establishes a target cost estimate. If actual costs are less than estimated costs, there is government sharing in the profits. Some of the previous analyses of cost estimation in government contracts has been primarily statistical. This study suggests that contractors may bias their cost estimates to conform with their profit maximizing objectives. Because of the peculiar sharing rule that characterizes these contracts, it is difficult for the government agency to distinguish between high and low-cost firms in the bases of target costs. The problem of discriminating between efficient and inefficient firms becomes less serious as the sharing proportion rises and approaches one, the fixed price contract where target costs are unambiguous indicators of the firm's expected costs. This article is relevant to water resource administrators concerned with contract standards and cost allocation. (Siegenthaler-Rutgers)
W71-04455

THE COSTS OF DECISION-MAKING,
Guelph Univ. (Ontario).
Alex C. Michalos.
Public Choice, Vol IX, No 3, p 39-51, Fall 1970.

Descriptors: *Decision-making, Economic evaluation, Economic efficiency, Risk, Operations research, Inventory.
Identifiers: *Cost accounting, Production costs, Implementation costs, Failure costs.

This paper constructs a system of cost accounting to be used in the evaluation of the costs of employing decision-makers and decision procedures. Distinctions were drawn among production, implementation, and failure costs. Production and implementation costs are subdivided into methods, materials, personal or overhead costs, while failure costs are subdivided into direct, indirect and estimated value losses. A comparison of the results was made with previous research. The advantage of using an inventory approach to decision-making in the future is that operations research theory becomes applicable to problems of group decision-making. This article is relevant for water administrators concerned with decision-making and project evaluation. (Siegenthaler-Rutgers)
W71-04457

AN ECONOMIC INTERPRETATION OF VOTING BEHAVIOR ON PUBLIC FINANCE ISSUES,
Basel Univ. (Switzerland).
Rene L. Frey, and Leopold Kohn.
Kyklos, Vol XXIII, Fasc 4, p 792-805, 1970.

Descriptors: *Decision making, *Costs, *Taxes, *Income, Economic evaluation, Government, Welfare economics, Financing, Optimization, Prices, Benefits, Social aspects, Government supports, Forecasting.
Identifiers: *Utility level, *Public goods, *Private opportunity costs, *Voting, *Public opportunity costs, Basel-Sadat.

In this paper the authors seek to analyze the voting behavior of individuals in public finance referenda. They assume that, in popular referenda, voters reveal their true preferences and the authors are thus able to analyze the individual's utility calculus. For this purpose they make use of three different cost concepts: (1) public opportunity costs, (2) private opportunity costs, and (3) expected tax increases. The authors make five hypothesis pertaining to the effect of these cost categories on the utility level of different income classes of voters and examine the determinants of the utility of public projects. The results are tested empirically, in the last part of the paper, for Basel-Sadat (Switzerland). The public good nature of water resource investments make optimal decision making difficult. Since the authors provide a measure of demand for public goods this article should be relevant to the decision process of water resource investments. (Murphy-Rutgers)
W71-04459

THE MARGINAL EFFICIENCY OF CAPITAL, THE INTERNAL RATE OF RETURN, AND NET PRESENT VALUE: AN ANALYSIS OF INVESTMENT CRITERIA,
Michigan State Univ., East Lansing.
James B. Ramsey.
Journal of Political Economy Vol 78, No 5, p 1017-1027, September-October 1970.

Descriptors: *Rate of return, *Economic efficiency, *Capital, *Rate of interest, Time, Costs, Investment, Economic evaluation, Price, Profit, Optimization, Equilibrium, Decision-making.
Identifiers: *Net present value, *Multiple roots, *Internal rate of return.

This paper attempts to show that the marginal efficiency of capital is not appropriate for ranking investment alternatives. This measure is an equilibrium concept and should be distinguished from the internal rate of return. The latter, when appropriately defined and used for ranking projects of equal time spans, is identifical to the ranking from net present value. It is also shown that the internal rate of return can always be calculated and has a unique value relative to the market interest rate. In the concluding section, an economic interpretation is given of the multiple roots solution of the marginal efficiency of capital and to the case where there are no real roots. The paper is relevant to the evaluation of alternative investment schemes among water projects. (Murphy-Rutgers)
W71-04460

INVESTMENT AND RATE OF RETURN FOR THE REGULATED FIRM,
American Telephone and Telegraph Co., New York.
Blaine E. Davis.
Bell Journal of Economics and Management Science Vol I, No 2, p 245-270, Autumn 1970.

Descriptors: *Utilities, *Government, *Optimization, Capital, Budget, Economic evaluation, Mathematical study, Investment, Management, Financing, Model studies.
Identifiers: *Rate of return, *Control the *Capital market, *Capital attraction capabi Market valuation.

This paper attempts to present a quantita framework showing what effect a rate of re specification can have on the structure and c position of the regulated firm's long-range inv ment decisions and the value the capital marke signs to the firm. It should be of particular inte to those concerned with the operation of pub regulated water utilities. A formulation developed for a regulated utility in terms o capital budgeting. This makes it possible for author to link the utility's investment decision (1) the method the capital market values the u ty, and (2) the restriction that rate-of-return r lation imposes on earnings. The paper dem strates that small changes in the rate of return have a dramatic impact on market valuation the firm's investment policy. (Murphy-Rutgers)
W71-04462

RESOURCE ALLOCATION WITH INCRE ING RETURNS TO SCALE,
Washington Univ., St. Louis, Mo.
Trout Rader.
American Economic Review, Vol LX, No 3, p 825, December 1970.

Descriptors: *Resource allocation, *Economic scale, *Economic efficiency, Optimization, W fare economics, Marginal costs, Prices, Budg Mathematical analysis.
Identifiers: *Consumer efficiency, *Producer ciency, Full employment, Competition, Distr tive justice.

This paper analyzes the necessary and suffic conditions for efficient allocation of resources the distribution of products. None of the usual fare conditions can be extended to the case o creasing returns to scale in one or more industr Since economics of scale are important in pu utilities, the author considers this a major defic cy of welfare economics. Since water utilities likely to have production functions exhibiting creasing returns, this paper is relevant to the w researcher. A producer efficiency is said to exi and only if: (1) industries try to maximize prod tion subject to their technology and with tradin factors allowed; (2) factors are fully employed industries minimize factor costs; (3) all factors employed and marginal rates of substitution equalized. There is consumer efficiency onl price equals marginal costs. If the output set is c vex, there is consumer efficiency if and only if tribution is competitive and GNP is maximi (Murphy-Rutgers)
W71-04463

THE USE OF SHADOW PRICES,
California Univ., Los Angeles.
Roland N. McKean.
In: Problems in Public Expenditure Analy Washington, D.C., The Brookings Institut 1968, p 33-77.

Descriptors: *Cost benefit analysis, *Prices, *M surement, *Economic evaluation, Governm Optimization, Welfare economics, Spillover, D sion-making, Cost minimization.
Identifiers: *Shadow prices, *Pareto optimal *Externalities, Market value, Nonmarket value.

This paper deals with the problem of measuring social costs and social benefits of a governm project. The author discusses the maximization society's welfare from Pareto optimal criteria. reasons that this can be pursued by attach prices, that accurately reflect the values of benefits to those who receive them and of the co to those responsible for their creation. Where ac rate private market comparisons cannot be ma shadow prices may be needed for accurate eval tions. However, their derivation is extremely c ficult due, in part, to the presence of externaliti In conclusion, the author states that benefit c

nalysis is an effective tool but, by itself, incapable f optimal decision-making. There is a significant otential use for shadow prices of water oriented creation activities in benefit cost justification of ater investments. This possible use plus the role of adow prices in other difficult to measure benefits akes this article relevant to water studies. Murphy-Rutgers)
71-04476

N THE DISCOUNT RATE FOR PUBLIC PRO-CTS,
nceton Univ., N.J.
lliam J. Baumol.
Public Expenditures and Policy Aanlysis, 1970, 73-290.

scriptors: *Rate of discount, *Interest rate, conomic evaluation, *Costs, *Government, nomic efficiency, Social aspects, Taxes, Risk, timization, Investment.
ntifiers: *Opportunity costs, *Rate of return, ond best, Externalities.

e discount rate is of critical importance for the luation of a government project due to its ef- on the allocation of resources between the ate and public sectors of the economy. The or demonstrates that the correct discount rate a government project is the rate of return the urces could earn in the private sector. In addi- to this, taxes in the private sector should be n into account and will call for a discount rate al to the before tax rate of return in the private or. The correct social discount rate is then a hted average of the opportunity cost rate for various sectors from which the project would its resources. The author reasons that there ld be no deductions for a risk component in ates of return observed in practice but that the t of externalities in both the government and te sector be allowed for. Concluding, the r argues that it is possible to derive figures iderably more defensible than conventional ulations. This article is relevant to the analysis overnment investments in water resources. also W71-04477) (Murphy-Rutgers)
-04481

DOW PRICES FOR INCORRECT OR NON-TENT MARKET VALUES,
sylvania Univ., Philadephia.
Margolis.
d by Haveman, Robert H. In: Public Expendi- and Policy Aanalysis, 1970, p 314-329.

iptors: *Prices, *Economic efficiency, ernment, Decision-making, Costs, Cost- it analysis, Rate of interest, Land, Demand, ts, Income, Markets, Economic evaluation.
fiers: *Shadow prices, *Public goods, PPBS, costs, Productivity.

paper focuses on the analysis of how govern- assign price-like values, or shadow prices, to nputs and outputs. Because of market imper- ns, relative prices do not reflect relative costs e therefore not always a measure of relative values. Shadow prices are computed to these social values. They are usually a cor- market price for both inputs and outputs e meant to explicitly consider the opportuni- s involved. In the case of many social goods, ution is often at zero price, thus giving no measure of the correct price. The inter- e good approach, the cost savings approach e direct estimation approach are procedures ed by the author to estimate prices. The cor- formation needed to calculate shadow prices s incentives for those who make and imple- he decisions. The absence of a market for of the benefits generated from water e development necessitates the computa- f shadow prices or implicit values. Ac- ly, this paper is relevant to the water her engaged in the estimation of social and benefits derived from water investments. so W71-04477) (Murphy-Rutgers)

W71-04482

POLLUTION CHARGES INCOME AND THE COSTS OF WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W71-04736

SOME DETERMINANTS OF DETROIT'S REGIONAL SHARE OF ECONOMIC ACTIVITY IN SELECTED INDUSTRIES,
Wayne State Univ., Detroit, Mich. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04762

REGIONAL TRADE AND STRUCTURE MODEL FOR POLLUTION ABATEMENT STUDY,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04763

TRADE STUDY RELEVANT TO POLLUTION ABATEMENT IN THE WESTERN BASIN OF LAKE ERIE,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-04764

OPTIMIZATION OF AN ELECTRODIALYSIS PLANT,
McDonnell Douglas Astronautics Co., Newport Beach, Calif. Water Technology Dept.
For primary bibliographic entry see Field 08C.
W71-04767

6D. Water Demand

EVALUATION OF THE DECISION PROCESS IN WATER RESOURCES PLANNING,
Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-04516

6E. Water Law and Institutions

PUBLIC BEACH, CITY OF NEW YORK, V WEST TENTH ST REALTY CORP (DISPUTE OVER SUBMERGED OCEAN LAND).

256 NY 222, 176 NE 173-174 (1931).

Descriptors: *New York, *Land tenure, *Riparian land, *Avulsion, Condemnation, Eminent domain, Compensation, Condemnation value, Real property, Legal aspects, Judicial decisions, High water mark, Boundaries (Property), Boundary disputes, Land, Ownership of beds.

Plaintiff public beach sought to condemn defendant's ocean front property. A portion of the land lay below the high water mark, having been formerly submerged by avulsion. Plaintiff contended that defendant did not own this portion, since his deed read 'to the Atlantic Ocean.' Defendant contended that his land included this strip, since a predecessor's conveyance was to the high water mark at the date. Noting that in the absence of a contrary intent, the grantor is presumed to have conveyed all he owned, not reserving the fee of submerged lands, the Court of Appeals of New York held that defendant's title extended past the present high water mark to include the avulsion. (Hart-Florida)
W71-04437

PEOPLE EX REL CARLSTROM V HATCH (OWNERSHIP OF MARSH MEANDERED AS A LAKE).
For primary bibliographic entry see Field 02H.
W71-04438

LUND V COX (ACTION TO QUIET TITLE AGAINST BATHING EASEMENT).
281 Mass 484, 183 NE 714-717 (1933).

Descriptors: *Massachusetts, *Easements, *Land tenure, *Boundary disputes, Boundaries (Property), Beaches, Swimming, Right-of-way, Judicial decisions, Legal aspects, High water mark, Low water mark, Recreation.

Plaintiff sought to quiet title free of incumbrances to beachfront property to which he held legal title. Defendant contended that she held bath-house and bathing privileges under a prior grant. Defendant contended that the grant of an easement in the 'beach' gave her rights in the property between high and low water marks. The Supreme Judicial Court of Massachusetts, in affirming a judgment for plaintiff, stated that in a deed passing title 'northerly by the sea,' the boundary would run along the low water mark. The court further stated that 'beach,' as used in the deed granting bathing privileges, meant the land above the high water mark, rather than the area between high and low water marks. (Hart-Florida)
W71-04443

NIAGARA FALLS POWER CO V WATER POWER AND CONTROL COMM'N (JUDICIAL REVIEW OF POWER COMMISSION'S RENTAL AWARD FOR WATERS OF NAVIGABLE RIVER).
267 NY 265, 196 NE 51-57 (1935).

Descriptors: *New York, *Administrative decisions, *Rent, *Hydroelectric plants, Hydroelectric project licensing, State governments, Legislation, Federal government, United States, Navigable rivers, Navigation, Dams, Diversion dams, Diversion, Treaties, Hydroelectric power, Administrative agencies, Judicial decisions, Legal aspects, Adjudication procedure, Permits.

Plaintiff power company sought review of defendant state commission's order fixing an annual rate of $5 per horsepower for water diverted from a navigable river. The statute permitting plaintiff to divert water reserved to the state the right to charge an equitable rental. Plaintiff contended that the rental was excessive. The Court of Appeals of New York noted that: (1) whether the river was navigable at the diversion point was immaterial for commerce purposes, since a river navigable in part is navigable in whole; (2) plaintiff was subject to congressional regulation of navigation; (3) Congress and the state have joint control of the public interest in the river; and (4) the statute permitted the state to charge rental for use of the water, not merely an administrative charge. The court observed that plaintiff was bound by the statute giving the state the right to charge an equitable rental. Since defendant had taken evidence bearing upon the reasonable rental value of the water diverted by plaintiff, there was no evidence that defendant's order was arbitrary. (Hart-Florida)
W71-04445

CLEVELAND, CC AND ST L RY V MUMFORD (ASSESSMENT OF RAILROAD FOR EXPENSES OF BUILDING LEVEE).
197 NE 826-837 (Ind 1935).

Descriptors: *Indiana, *Levees, *Railroads, *Assessments, Compensation, Eminent domain, Condemnation, Payment, Bridges, Floods, Navigable rivers, Rivers, Federal government, United States, Flood protection, Dikes, Shore protection, Judicial decisions, Legal aspects, Drains, Governments, State governments, Navigation, Flood control, Taxes.

Plaintiff railroad company brought action to prevent construction of a levee. Several rivers frequently overflowed, and defendant riparian landowner petitioned for construction of the levee, which would force plaintiff to rebuild its track in the affected area. Furthermore, plaintiff was to be assessed for benefits derived from the levee. Plain-

tiff contended that damages should be allowed for its rebuilding expenses. The Supreme Court of Indiana stated that: (1) congressional approval was not required to construct the levees, since federal control extended only to the channel of navigable streams; (2) plaintiff's property was subject to the state police power to construct levees for public benefit; (3) plaintiff must conform its bridges and tracks to the levees without compensation; (4) requiring plaintiff to rebuild was not a fifth amendment taking of property; (5) plaintiff could be assessed for any special benefit exceeding community benefit; (6) whether plaintiff's property was specially benefited was a fact question; and (7) if plaintiff received no special benefits, assessment would be a fifth amendment taking. Although determing that plaintiff could not recover rebuilding expenses, the court held that plaintiff could not be assessed except for special benefits exceeding rebuilding expenses. (Hart-Florida)
W71-04464

CRAGE V CITY OF BUFFALO (DISCHARGE OF SEWAGE INTO CANAL AS NUISANCE).
6 NE2d 607 (1937).

Descriptors: *New York, *Sewage, *Water pollution, *Canals, Sewage disposal, Domestic wastes, Water pollution sources, Legal aspects, Judicial decisions, Waste disposal, Disposal.

Plaintiff's land was contiguous to defendant's canal. The sewers from plaintiff's land as well as from that of others discharged into the canal. After diverting his own sewage from the canal, plaintiff sued, contending that the sewage discharge was a nuisance. The Court of Appeals of New York held that: (1) plaintiff took possession of the premises knowing of the sewage discharge, (2) that neither plaintiff nor his predecessors had any right to discharge sewage into the canal, and (3) that plaintiff had created a great part of the nuisance. Accordingly the decree of the lower court dismissing the complaint was affirmed. (Hart-Florida)
W71-04490

BLATCHFORD V VOSS (DISPUTES OVER SUPREMACY OF MEANDER OR PLAT LINE).
219 NW 100-102 (Wis 1928).

Descriptors: *Wisconsin, *Land tenure, *Boundary disputes, *Meanders, United States, Riparian land, Lakes, Boundaries (Property), Shores, Real property, Legal aspects, Judicial decisions, Land.

Plaintiff riparian landowner brought ejectment against defendant riparian landowner. Defendant owned two lots, one north of plaintiff's and another west of plaintiff's. A small lake inlet extended through defendant's west lot and into plaintiff's lot. Plaintiff claimed land north of the inlet within the northern plat line of defendant's west lot. Plaintiff asserted that since the government survey showed a meander line as his west boundary, he was entitled to all the land extending to the actual water line. The Supreme Court of Wisconsin stated that in conveyance from the United States, the water line, rather than the meander line, is the true boundary. However, if there is no water nearby, this rule is inapplicable. Determining that when there is a conflict, meander lines are subordinate to section lines, the court held that plaintiff's lot could not extend past the section line since the water was distant from the meander line and defendant's plat line was paramount. (Hart-Florida)
W71-04520

EAST BAY SPORTING CLUB V MILLER (RIGHT OF PUBLIC TO USE PRIVATE WILDLIFE-MANAGEMENT LANDS ON LAKE ERIE).
118 Ohio St 360, 161 NE 12-16 (1928).

Descriptors: *Ohio, *Lake Erie, *Fishing, *Navigable waters, Fish management, Recreation, Fish conservation, Lakes, Bays, Watercourses (Legal), Intermittent streams, Judicial decisions, Marshes, Wildlife conservation, Wildlife, Wildlife habitats, Wildlife management, Legal aspects.

Plaintiff sporting club brought action to enjoin defendant citizen from hunting and fishing upon its lands. The disputed lands were primarily marshes. Defendant asserted the right to hunt and fish the lands as a member of the public and asserted that deprivation of such right was unconstitutional. The Supreme Court of Ohio noted that: (1) the public is entitled to fish in Lake Erie and its open bay regardless of whether such waters are navigable, (2) waters capable of use as highways for commerce are navigable, and (3) a 'watercourse' is a stream in a natural channel discharging into a larger body of water. Since part of the disputed land was part of a bay of Lake Erie, the court held that defendant was entitled to fish that portion. However, since plaintiff established ownership of the remaining land, which was not part of Lake Erie, the court enjoined defendant from trespassing upon the remainder. (Hart-Florida)
W71-04529

CITY OF NORWOOD V SHEEN (DAMAGES FOR SEWAGE DISCHARGE ONTO PRIVATE PROPERTY).
183 NE 177 (Ct App Ohio 1932).

Descriptors: *Ohio, *Sewage disposal, *Sewers, *Eminent domain, Damages, Cities, Land, Land tenure, Judicial decisions, Legal aspects, Adjudication procedure, Water pollution, Sewage, Overflow, Compensation, Eminent domain, Discharge (Water), Waste disposal.

Plaintiff executor of decedent's estate brought suit for damages against defendant city for appropriation of property. Defendant had taken over a sewer and allowed sewage to flow upon decedent's property during decedent's lifetime. Plaintiff contended that this amounted to appropriation of decedent's property. Defendant claimed that, if any cause of action existed, it existed by reason of the creation of a nuisance and the right of action abated on the death of decedent. The trial court returned a verdict for plaintiff and the Court of Appeals of Ohio affirmed. The act of the city permitting sewage to flow over decedent's land constituted an appropriation for such use. The disposal of sewage is a governmental function which may amount to appropriation requiring compensation to the damaged party. Defendant's contention that the act was only actionable on the theory of nuisance was incorrect. (Duss-Florida)
W71-04532

BARNES V PECK (ADDITIONAL USE OF WATER RIGHTS CONDEMNED FOR AUGMENTATION OF CITY WATER SUPPLY).
187 NE 176-182 (Mass 1933).

Descriptors: *Massachusetts, *Water supply, *Eminent domain, *Water rights, Damages, Compensation, Water utilization, Administrative agencies, Easements, Rivers, Streams, Land, Legislation, Domestic water, Construction, Cities, Waterfalls, Electric power, Reasonable use, Legal aspects, Judicial decisions, Adjudication procedure, Condemnation, Hydroelectric power.

Plaintiffs sought to invalidate the taking of land by defendant city and defendants claiming through the city. The land was taken to increase the city's water supply. Plaintiffs contended that the taking of land and water rights was illegal in that: (1) the state statute authorizing the taking was not complied with, and (2) the city exceeded its rights in the water by using it to generate electricity for sale. Plaintiffs had been awarded damages for the taking but had refused them. The lower court dismissed plaintiffs' actions and the Supreme Judicial Court of Massachusetts affirmed. All of plaintiffs' constitutional and statutory rights were protected and complied with by the city in the taking. The city did not exceed its water rights by generating and selling electricity. The statutory authority for the taki
the water encompassed uses other than the
cipal one of increasing the water supply. The
development of electricity was incidental t
main purpose of increasing its water supply an
therefore within the statute authorizing th
creased water supply. (Duss-Florida)
W71-04539

MANAGEMENT AND ADMINISTRATION GROUNDWATER IN INTERSTATE AND TERNATIONAL AQUIFERS, PHASE I,
Bittinger (M. W.) and Associates, Inc., Fort
lins, Colo.
For primary bibliographic entry see Field 04B.
W71-04541

CONTROL OF SPILLAGE OF HAZARI POLLUTING SUBSTANCES,
Battelle Memorial Inst., Richland, Wash. P
Northwest Labs.
For primary bibliographic entry see Field 05G.
W71-04615

FLORIDA GRAVEL CO V CAPITAL SAND AND GRAVEL CO (OWNERSHIP BED OF STREAM).

154 SE 255-257 (Ga 1930).

Descriptors: *Georgia, *Ownership of
*Gravels, *Navigable waters, Non-navi
waters, Navigable rivers, Rivers, Beds, Beds
water, Boundary disputes, Boundaries (Prop
Land tenure, Real property, Streams, Judicial
sions, Legal aspects, Navigation, Easements, S
State governments.

Plaintiff gravel company sought to enjoin d
dant sand company from removing sand and g
from lands below the low water mark in a rive
Plaintiff was a lessee of the disputed lands ar
serted that his lessor's title extended to the t
of the stream. The Supreme Court of Ge
categorized streams into three types: (1) w
private; (2) beds owned privately, but subjec
public easement to use the stream as a high
and (3) wholly public watercourses, in whic
tide ebbs and flows. Determining that the stre
question was the second type, since it had no
but was navigable in fact, the court held that
tiff's lessor's title extended to the thread o
stream and that plaintiff had the exclusive rig
mine sand and gravel from the river bed o
leased property. (Hart-Florida)
W71-04624

SANTEE RIVER CYPRESS LUMBER CO V LIOTT (BOUNDARIES OF SWAMPLAND).
150 SE 683-691 (SC 1929).

Descriptors: *South Carolina, *Land te
*Boundaries (Property), *Swamps, Boun
disputes, Real property, High water mark, Lur
Lumbering, Judicial decisions, Legal aspects.

Plaintiff landowner sought damages and an in
tion because defendant cut timber on plain
land under claim of right. At trial the case deve
into an issue of title and possession of a portio
the disputed lands, which were bounded by
high water mark of a swamp. Plaintiff appe
from a verdict and judgment for defendant.
was alleged in the lower court's charge to the
as to the definition of 'high water mark'. The
court had defined 'high water mark' as 'a ma
appearance on the ground made by, and the
of, usual high water--it means a difference in s
growth or both and does not refer to tempo
floods unusual and brief which may cover
areas'. The Supreme Court of South Carolina
that the trial court had not erred in defining
water mark for the jury. (Hart-Florida)
W71-04625

THE FEDERATION AND PURE WATERS,
For primary bibliographic entry see Field 05G.
W71-04640

MEND THE WATERSHED PROTECTION ND FLOOD PREVENTION ACT.
earings, Subcomm on Conservation and Credit, omm on Agriculture, US House of Reps, 89th ong, 1st Sess, Oct 11, 1965, p 69-82.

escriptors: *Legislation, *Watershed Protect. and ood Prev. Act, *Multiple-purpose projects, Water utilization, Watersheds (Basins), Water pply, Dams, Flood protection, Flood control, ildlife management, Reservoirs, Cities, Manage-ent, Recreation, Fish management, Irrigation ter, Water management (Applied), Wildlife, oodwater, Upstream reservoir sites, Reservoir orage, Project benefits, Cost-benefit analysis, sts, Acreage.
ntifiers: *Floodwater detention capacity.

arings before the Subcommittee on Conserva-n and Credit of the House Committee on riculture were held for the purpose of consider-amendments to the Watershed Protection and od Prevention Act. Considered were H.R. 2468, . 4812, H.R. 5149, H.R. 9149, H.R. 9917, and . 10241--all of the 89th Congress, first session. Watershed Protection and Flood Prevention limited the size of dams to a flood-detention acity of 5000 acre-feet. At the same time it al-ed a 25,000 acre-feet capacity for reservoirs n which water was available for municipalities, and wildlife development, irrigation, and reation. Unless the dams were located upstream re water supply was inadequate to permit mul-e-purpose development it was impossible for small dams to hold back sufficient floodwater the full allowable reservoir capacity of 25,000 . The amendments considered increased the tation on floodwater detention capacity from 0 to 12,500 acre feet, thereby providing for the utilization of available reservoir sites for multi-purposes. Moreover, increasing the limitation loodwater detention capacity to 12,500 acre-would also result in reduction of overall pro-costs and increase the benefits in some rsheds. (See also W71-04642) (Duss-Florida)
-04641

ERSHED PROJECTS.

ings, Subcomm on Conservation and Credit, m on Agriculture, US House of Reps, 89th , 1st Sess, March 16, 17, July 20, 22, Aug 30, 21, 22, Oct 11, 1965. 253 p.

riptors: *Flood protection, *Watersheds ns), *Flood control, *Legislation, Project pur-, Project planning, Watershed management, nel improvement, Stream improvement, Crop ction, Federal government, Local govern-, State governments, Financing, Public lands, use, Flood damage, Cost-benefit analysis, lination, Structures.

ngs before the Subcommittee on Conserva-and Credit of the House Committee on lture were held to consider watershed pro-ubmitted and recommended by the Depart-f Agriculture. States in which projects were located included: Alabama, Arkansas, a, California, Florida, Indiana, Iowa, Kansas, ana, Mississippi, Nebraska, Nevada, New , New Mexico, North Carolina, North a, Ohio, Oklahoma, Pennsylvania, South na, Tennessee, Texas, Utah, Vermont, Vir-West Virginia, and Wisconsin. The purpose e projects was primarily flood prevention. In f the districts where cropland predominated ther watershed land uses, there was con-le flood damage, resulting in high produc-sts and low crop yields. In general, flooding uted to overall underdevelopment in the eds and surrounding communities. There-here was a need for assistance from the government to the various districts in order to prevent such flood damage. Many projects demonstrated cooperation between the federal government, state governments and local governments, with reference to financing and planning. (See also W71-04641) (Duss-Florida)
W71-04642

A BEGINNERS GUIDE TO RESEARCH IN NATURAL RESOURCES LEGISLATION AND POLICY DEVELOPMENT,
Central Washington State Coll., Ellensburg.
K. A. Hammond, and Carolyn Willberg.
December 1969. 54 p, 6 ref. OWRR Project B-019-WASH (3).

Descriptors: *Natural resources, *Legislation, *Publications, *Information retrieval, Methodology, State governments, Federal government, Legal aspects, Judicial decisions, Local governments, Water resources development, Political aspects, Administrative agencies, Washington, Data collection, Research and development, Bibliographies, Conferences, Documentation, Libraries, Technical societies.
Identifiers: *Legislative history, *Public policy.

Designed as a manual for student use, this guide provides an approach to research in natural resources legislation and policy development. The guide is suited to researching specific legislation as well as general topics and points out that political bias must be considered in researching legislative history. At the federal level, the manual presents guides for tracing the history of bills and resolutions from their introduction through committee hearings and reports to congressional debate and enactment. Use of the Congressional Record is examined, and procedures for locating and obtaining legislative documents are outlined. The manual also examines the use of statutes, executive documents, general reference sources, agency publications, and publications of private interest groups. Part II covers resources legislation at the state level, where documentation is often incomplete or nonexistent. Much state material is never documented or published; therefore, specific information requests and interviews are primary sources of material in state research. Using the state of Washington as an example, the manual discusses sources dealing with legislative history, statutes, judicial decisions, attorney general's opinions, legislative reviews, municipal ordinances and voting information. (Liptak-Florida)
W71-04645

PERMITS FOR DISCHARGES OR DEPOSITS INTO NAVIGABLE WATERS.
Corps of Engineers, Washington, D.C.

Federal Register, Vol 36, No 14, Thursday, January 21, 1971, p 983-984.

Descriptors: *Water quality control, *Permits, *Rivers and Harbors Act, *Administrative decisions, Navigation, Waste disposal, Navigable waters, United States, Water quality, Public health, Water pollution, Water pollution sources, Water resources, Legislation, Water pollution abatement, Administration, Administrative agencies, Decision making, Water policy, Effluents, Wastes, Regulation, Waste water (Pollution).
Identifiers: *Environmental Policy Act, *Corps of Engineers.

In recognition of the duties of the Secretary of the Army under the Refuse Act of 1899 and of the responsibilities of the Environmental Protection Agency (EPA) under the National Environmental Policy Act of 1969, the Secretary proposed a memorandum of understanding between the Secretary and the EPA to guide the Corps of Engineers in implementing the Refuse Act permit program. The Corps' policy will be to coordinate with the EPA all applications for permits to discharge refuse into navigable waters. The EPA will advise the Corps of the impact of the proposed discharge on water quality standards and the EPA's findings will be conclusive. The memorandum establishes procedures for application, state certification under the Federal Water Pollution Control Act, and guidelines to be considered by the EPA in processing applications. In the absence of objection from the EPA, the Corps may deny a permit only if it impairs navigation or adversely affects fish and wildlife resources under the meaning of the Fish and Wildlife Coordination Act. The Corps will also consult the EPA before adopting rules, regulations, policies, or procedures under the Refuse Act or relating to the memorandum. Permits shall require compliance with applicable water quality standards, provide for suspension or revocation for non-compliance or changed conditions adversely affecting water quality standards, permit inspection and sampling, and provide for periodic reports on the nature and quantity of refuse discharged. (Liptak-Florida)
W71-04646

FINANCIAL RESPONSIBILITY FOR OIL POLLUTION CLEANUP.
Federal Maritime Commission, Washington, D.C.

Federal Register, Vol 36, No 14, Thursday, January 21, 1971, p 996-997.

Descriptors: *Ships, *Oil, *Administrative decisions, *Insurance, Water pollution control, Pollution abatement, Federal government, United States, Water pollution, Water quality control, Water pollution sources, Legislation, Administration, Administrative agencies, Decision making, Legal aspects, Risks, Compensation, Damages, Adjudication procedure, Remedies.
Identifiers: *Oil spills, *Water Quality Improvement Act.

In order to implement the financial responsibility provisions of section 11 (p) (1) of the Federal Water Pollution Control Act, the Federal Maritime Commission adopted regulations requiring owners of vessels exceeding 300 gross tons to evidence their financial responsibility to meet potential liability to the United States resulting from oil discharges in United States' waters. The Act permits direct action against the insurer or underwriter and allows the insurer to raise all defenses the owners could have raised. To implement this provision, the Federal Maritime Commission regulations set out a uniform policy endorsement, certificate of insurance, surety bond form, and guarantee form in which the insurer agrees to direct action. Upon the objection of several underwriters that the language of the standard forms was subject to possible misinterpretation regarding the extent of rights and defenses available to the insurer, the Commission gives notice of proposed adoption of clarifying language in the regulations. The changes will make the new language optional with the insurer, and the Commission may accept either the original or alternative language. (Liptak-Florida)
W71-04647

SOME RECENT DEVELOPMENTS CONCERNING FISHING AND THE CONSERVATION OF THE LIVING RESOURCES OF THE HIGH SEAS,
California Univ., San Diego. Inst. of Marine Resources.
Milner B. Schaefer.
San Diego Law Review, Vol 7, No 3, p 371-407, July 1970. 106 ref.

Descriptors: *Marine fisheries, *Conservation, *International law, *International waters, Law of the sea, Legal aspects, Treaties, Continental Shelf, Marine animals, Marine fish, Commercial fishing, Oceans, Exploitation, United States, Foreign countries, United Nations, International commissions, Navigation, Aquatic life, Crustaceans, Fish, Fish conservation, Beds.
Identifiers: *Territorial seas.

Discussing current developments concerning fishing and conservation of living resources in the high

seas, this article focuses upon the problems of the present international legal framework and the recent activities of nations in international fishery affairs. Particular emphasis is given to the practice and policy of the United States. The present legal framework is made up of the four conventions adopted at the 1958 International Conference on the Law of the Sea. These conventions concern: (1) the high seas, (2) the territorial sea and the contiguous zone, (3) the Continental Shelf, and (4) fishing and conservation of living resources of the high seas. The author notes that these conventions are inadequate in that they do not: (1) establish limitations on the use of resources, (2) specify who is to have access to resources on the high seas, (3) specify who should prescribe policies regarding access, and (4) establish procedures whereby disputes over policies may be settled. The convention on Fishing and Conservation is particularly weak because few nations have ratified it. Regarding recent developments, the author discusses nations' claims of exclusive jurisdiction over living resources in coastal waters and in Continental Shelf waters. Current problems in what constitutes conservation of resources are considered. Finally, the author examines methods employed in settling disputes between nations and proposals for a more uniform system in the future. (Duss-Florida)
W71-04648

THE THEORY AND PRACTICE OF INTERNATIONAL FISHERY DEVELOPMENT-MANAGEMENT,
Ralston Purina Co., St. Louis, Mo.
Wilbert McLeod Chapman.
San Diego Law Review, Vol 7, No 3, p 408-454, July 1970. 83 ref.

Descriptors: *Marine fisheries, *Fish conservation, *International commissions, Law of the sea, *International law, Fish management, Fisheries, United Nations, Treaties, Exploration, Exploitation, Technology, Economics, Regulation, Oceans, Commercial fisheries, Fish behavior, Migration patterns, Research and development, Fish populations, Environment, Environmental effects, Seas, Legal aspects.

Because of the rapid development of the marine fishing effort on a world-wide basis, the author of this article sees a great need for marine fish conservation and management. The article focuses upon the present international machinery for fishery regulation and seeks to assess its efficacy--whether it needs strengthening or whether an entirely new international framework should be established. Among the existing international fishery commissions and bodies discussed are: (1) the International Commission for the Exploitation of the Sea; (2) the Fur Seal Convention; (3) the International Pacific Halibut Commission and similar conventions; (4) the International Whaling Commission; (5) the Indo-Pacific Fisheries Council, and the Food and Agriculture Organization of the United Nations; (6) the International Commission for the Northwest Atlantic Fisheries; (7) various restrictive fishery conventions; and (8) various fishing-rights agreements between nations. The author emphasizes the importance of scientific analysis of fish populations in the area of conservation. He concludes that existing organizations have contributed much in the way of mitigating disputes between nations and improving our knowledge of the ocean, its resources, and fishing. However, the author does see the need for a major overhaul of the United Nations machinery for dealing with ocean-oriented problems. There is particular need for improved funding of scientific research into fishing problems. (Duss-Florida)
W71-04649

INTERNATIONAL AND NATIONAL REGULATION OF POLLUTION FROM OFFSHORE OIL PRODUCTION,
Nospaman, Waters, Scott, Krueger and Riordan, Los Angeles, Calif.
Robert B. Krueger.
San Diego Law Review, Vol 7, No 3, p 541-573, July 1970. 33 p, 138 ref.

Descriptors: *Water pollution, *Oil industry, *Offshore platforms, *Exploitation, Legislation, Oil wells, International law, International waters, Natural gas, Oil, Oil fields, Exploration, Water pollution sources, Water pollution effects, Water pollution control, Pollutants, Pollution abatement, Administrative agencies, Water Quality Act, Legal aspects, Regulation.
Identifiers: Outer Continental Shelf Lands Act, Oil spills.

The petroleum resources available on the Continental Shelf and their relation to world supply are examined by this article to show that exploitation of offshore petroleum is necessary. The author discusses in detail the various international conventions establishing agreements between riparian nations to pevent oil pollution. President Nixon proposed to the United Nations that all nations adopt a treaty renouncing claims over natural resources of the seabed beyond the point where the high seas are 200 meters deep and agree to regard these resources as the 'common heritage of mankind.' The author analyzes considerations for and against the President's proposal, pointing out that underdeveloped nations are relatively unconcerned about pollution. It is also suggested that pollution from offshore wells is not nearly so disastrous as a wrecked oil tanker, such as the Torrey Canyon. The author concludes that techniques are available and can be developed which would greatly reduce any chance of spillage from offshore wells. In addition, the Outer Continental Shelf Lands Act, the Water Quality Improvement Act, and the National Environmental Improvement Act are examined as means of preventing pollution. (Hart-Florida)
W71-04650

OCEAN POLLUTION: AN EXAMINATION OF THE PROBLEM AND AN APPEAL FOR INTERNATIONAL COOPERATION,
Douglas D. Busch, and Edward I. Mears.
San Diego Law Review, Vol 7, No 3, p 574-604, July 1970. 31 p, 94 ref.

Descriptors: *Oceans, *Water pollution, *Water pollution control, *International waters, International law, International commissions, Pollution abatement, Water pollution sources, Water pollution effects, Estuaries, Water pollution treatment, Pollutants, Public health, United States, Foreign waters, Thermal pollution, Non-structural alternatives, Oil, Oily waters, Pesticides, Pesticide residue, Pesticide drift, Pesticide removal.
Identifiers: *International cooperation, *Ocean pollution.

Emphasizing that man's survival depends upon the oceans, this article notes that man can no longer ignore ocean pollution. The impact of pollution upon estuaries and the high seas is considered first, wherein the author notes that many marine organisms depend upon clean estuaries during part of their life. Marine pollution is next considered. The author discusses in detail specific pollutants, sources, and the effects of pesticides and petroleum. The analysis of sources includes an examination of the polluting effects of man's land activities, man's surface activities, and man's exploitation of sea resources. To solve the ocean pollution, there is a need for international cooperation. Present treaties are inadequate, and United Nations regulation of international pollution is difficult. The problem of defining what pollution is to be abated on an international level is examined. Whether regional or international control would be a better method of pollution control is briefly considered. The author concludes with fourteen recommendations for controlling ocean pollution. (Hart-Florida)
W71-04651

PROPERTY--WHARFING OUT--RIPARIAN OWNER PERMITTED TO USE FILLED-IN SWAMP AS A WHARF TO REACH NAVI BLE WATER,
Jack L. Schoellerman.
San Diego Law Review, Vol 7, No 3, p 684-
July 1970. 38 ref.

Descriptors: *Landfills, *Riparian rights, *Ripa land, *Access routes, Accretion (Legal aspe Judicial decisions, Docks, Boundaries (Prope Boundary disputes, Land tenure, Real prop Navigable waters, Land forming, Public he Mosquitoes, Lagoons, Legal aspects, P Swamps.
Identifiers: *Wharfage.

In Burns v Forbes, 412 F2d 995 (3rd Cir 19 plaintiff riparian landowner filled in the lago front of his land to gain access to navigable w and to abate mosquito proliferation. Defenda contiguous landowner, fenced across plain landfill and cut off plaintiff's access to the na ble waters. Plaintiff sued to enjoin defendant maintaining the fence. The trial court held plaintiff did not have title to the filled land dismissed the action. On appeal, the Third Ci Court of Appeals reversed and held that plaintiff did not own the land he created, the fill was to be considered an exercise of plain riparian right to wharf to navigable water judgment was entered directing defendan remove the fence. This case comment praise Burns decision as an imaginative solution. court reasoned that since a riparian owner ca create an accretion and acquire title to it, the fill must be public. Since the landfill is public comment raises a question as to the quantity o rights in the fill which inhere to the public. (Florida)
W71-04652

THE CONTINENTAL SHELF'S OUTER BO DARY--A POSTSCRIPT,
Naval War Coll., Newport, R.I.
L. L. E. Goldie.
Journal of Maritime Law and Commerce, V No 1, p 173-178, Oct 1970. 6 ref.

Descriptors: *Continental Shelf, *Contin Margin, *Jurisdiction, *International law, La the sea, Boundary disputes, Boundaries (Prope International waters, Treaties, Foreign wa Political aspects, Governments, Foreign go ments, Coasts, Political constraints, Coordina Administration, Oceans, Legislation, Legal asp

Discussed in this article is the viability of prop alternative regimes to govern the zone betwee outer limits of the Continental Shelf and the tinental Rise. The following international leg tive blueprints, suitable to varied coastal situations, are advocated by the author: (1) b ing such zones within the coastal state's re where a clear claim exists to the appurtenant (2) bringing the zone under an international re while leaving its administration in the co state's hands, (3) co-operative administra among coastal states where overlapping claim ist, and (4) entirely international regimes w political realities make co-operation impos The relative merits of the author's scheme ar amined in light of the Stratton Commis proposals, the scheme's political marketability its stabilizing potential on international pol (Earl-Florida)
W71-04653

TWO NEGLECTED PROBLEMS IN DRAFT REGIMES FOR DEEP OCEAN RESOURCES
American Journal of International Law, Vol 64 5, p 905-919, Oct 1970. 50 ref.

Descriptors: *Water resources development, of the sea, *International law, *Oceans, L aspects, International commissions, Contin Shelf, Resources, Regulation, Ownership of b Exploitation, Exploration, United Nations, T ties, Mineralogy, Relative rights, Beds under wa
Identifiers: Ocean resources.

Considering two essential yet neglected legal spects of proposals for international regimes to overn deep-ocean resources, the author of this arcle discusses: (1) the legal quality of title that a ate may have over deep-ocean resources, and (2) eans of assuring transnational recognition of title deep-ocean resources. To illustrate these points, e author critically evaluates the Stratton Comission Report which sought to redefine the Conental Shelf, establish intermediate zones beyond e shelf, and establish an international framework r registering claims to resources and for financing search and development of resources. The chief oblem with the quality of title under the Commisn's registry authority is that it adopts a 'firstme, first-registered' system and is not so much a ims-registration regime as a mere recording one. for transnational recognition of title, the Comssion failed to specify whether it favored a full-th-and-credit or national treatment of foreign ti-. A model developed from analogies to the quirements of recognition of perfected security erests under the Uniform Commercial Code ght be preferable to either system. (Duss-rida)
1-04654

ADOWLANDS REGIONAL DEVELOPMENT ENCY V STATE (VALIDITY OF STATE CLAMATION AND DEVELOPMENT ACT).

NJ Super 89, 270 A2d 418-443 (1970).

criptors: *New Jersey, *Legislation, *Reclama-, *Environment, Water pollution, Balance of re, Waste disposal, Solid wastes, Waste treat-t, River basins, Marshes, Cities, Sewage treat-t, Legal aspects, Judicial decisions, Grasslands, d, Land use, Land reclamation, Environmental cts, New York.

ntiffs sought to invalidate a statute which pro-d for reclamation and development of dowlands located in New York and northeast-New Jersey. Among the objectives of the te were: (1) to protect the area from air and r pollution, (2) to provide solid waste disposal, (3) to preserve the balance of nature. Plaintiffs ked the act principally upon constitutional nds, alleging, among other things: (1) that the as a special rather than general law, (2) that were improper delegations of power, and (3) t violated various sections of the New Jersey United States Constitutions. The Superior t of New Jersey found the act valid in all cts. (Duss-Florida)
04655

ACT TO CREATE AN AGENCY OF ENNMENTAL CONSERVATION.

of Vermont, No 246, 1969 Adjourned Ses-1970).

iptors: *Vermont, *Environment, *Adminis-agencies, *Conservation, State govern-, Administration, Water resources develop-Coordination, Governments, Legislation, aspects, Leadership, Supervisory control r), Regulation, Decision making.

ncy of environmental conservation is hereby d, composed of the following pre-existing gencies: (1) fish and game department; (2) and parks department; (3) environmental (4) division of protection; (5) recreation (6) committee on natural resources; (7) resources department; and (8) natural ces council of the department of agriculture. nctions of these subdivisions are advisory ith the administrative, policy making, rule , and regulatory functions vested in the ry of the newly consolidated agency. The ry is appointed by the governor. His duties plan, coordinate, and direct the functions in the agency, and to appoint the commisof each subdivision. The rules and regula-the sub-agencies are transferred to the con-d agency. (Hart-Florida)
656

WHOLESALE LAUNDRY BD OF TRADE, INC V CITY OF NEW YORK (CONSTITUTIONALITY OF INCREASED WATER RATES).
315 NYS2d 715-717 (Sup Ct 1970).

Descriptors: *New York, *Water rates, *Administrative decisions, *Local governments, Public utilities, Water supply, Cities, Regulation, Administrative agencies, Administrative decisions, Water users, Utilities, Legal aspects, Judicial decisions, Costs.

Plaintiff laundry corporations sought to restrain defendant city from enforcing increased water rates promulgated by the Administration of Environmental Protection and approved by the Board of Estimate. The state constitution provided that local government may make a fair return on the value of property used in the operation of public utilities. Profit was allowed in addition to the cost of service and taxes which would be paid to local governments if the service were privately owned. Plaintiffs contended that the proposed increase would give the city an excessive return. Defendant alleged that the increase would not bring about an excessive return. The Supreme Court of New York County granted defendant summary judgment. The return on the city's investment would not exceed the fair legal rate of return as set by the Banking Board. (Duss-Florida)
W71-04657

FRIEDLAND V STATE (LIABILITY OF STATE FOR ALTERING FLOW OF STREAM).
314 NYS2d 935-938 (Sup Ct App Div 1970).

Descriptors: *New York, *Surface waters, *Alteration of flow, *Reasonable use, Diversion, Relative rights, Riparian rights, Streamflow, Watercourses (Legal), Riparian land, Surface runoff, Rainfall, Highways, Construction, Ponds, Flow, Natural flow doctrine, Land, Land tenure, Percolating water, Surface drainage, Channels, Damages, Judicial decisions, Legal aspects.

Plaintiff landowners sought damages from defendant state for interference with a stream which fed a pond on plaintiffs' land. Defendant had constructed a highway, thereby diverting and rechanneling the stream which passed through plaintiffs' property. Plaintiffs contended that these acts so altered the discharge of surface water that, depending on the amount of rainfall, algae formed in the pond or the pondwater became stagnant. The Supreme Court of New York reversed a lower court decision for plaintiffs. The court applied several principles of law to the facts of this case, including: (1) the right of a landowner to divert streams flowing through his land so long as they are returned to their normal channel before reaching land of lower owners, (2) liability for willful diversion of water onto neighboring land, (3) the equal rights of upper and lower riparian owners to deal with surface waters on their property, (4) the amount of surface water which may be discharged into a natural watercourse after construction of municipal improvements, and (5) the right of a landowner to reasonably use percolating waters on his land. Applying these principles the court found that the record did not sustain liability on the part of the state. (Duss-Florida)
W71-04658

OWEN V HUBBARD (BOUNDARY DISPUTE OVER TITLE TO BULKHEAD).
271 A2d 672-682 (Ct App Md 1970).

Descriptors: *Maryland, *Boundary disputes, *Riparian rights, *Bulkheads, Navigable waters, Relative rights, Land, Riparian land, Property (Boundaries), Permits, Easements, Channels, Legislation, High water mark, Banks, Shores, Accretion (Legal aspects), Construction, Tidal waters, Riparian waters, Legal aspects, Judicial decisions, Adjudication procedure, Remedies.

Plaintiff riparian landowners sought a declaratory judgment determining title to a portion of a bulkhead constructed by defendant adjacent riparian landowners. Defendants constructed the entire bulkhead with plaintiffs' consent, and plaintiffs contended that their consent extended to construction of a leg of the bulkhead along their riparian property. Defendants contended that the boundary between the two properties showed that they did not construct any part along a riparian course owned by plaintiffs, and that, even if they had, plaintiffs' mere side rights should not prevail over defendants' right to use and possess the improvements they erected. The Court of Appeals of Maryland affirmed a lower court's decree for plaintiffs. A permanent easement for use and enjoyment of the bulkhead was granted defendants. Though the evidence was conflicting, the trial court's determination that plaintiffs' land behind the disputed bulkhead was riparian was not clearly erroneous. A Maryland statute grants riparian owners the exclusive right to make improvements into waters fronting their land. This statute is not susceptible to a construction prejudicing riparian rights where improvements are made on the side of riparian land. Title to that portion of the bulkhead extending in front of plaintiffs' land was thus in plaintiffs. (Duss-Florida)
W71-04659

KENNY CONSTRUCTION CO V METROPOLITAN SANITARY DIST (SANITARY DISTRICT'S NONLIABILITY FOR CONSTRUCTION COSTS IN EXCESS OF CONTRACT).
262 NE2d 842-850 (Ct App Ill 1970).

Descriptors: *Illinois, *Contracts, *Construction costs, *Sewers, Adjusted costs, Claims (Contracts), Change orders, Negotiations, Engineers estimates, Bids, Performance, Specifications, Contract administration, Drainage programs, Administration, Materials, Subsurface waters, Drainage systems, Tunneling, Sanitary engineering, Subsoil, Legal aspects, Judicial decisions, Construction materials. Identifiers: *Sanitary districts.

Plaintiff construction company sought recovery of additional costs incurred in sewer construction for defendant sanitary district. During construction plaintiff encountered allegedly unforeseen subsurface water. Plaintiff obtained defendant's written approval of certain changes in construction methods and material, but failed to obtain the contractually required written consent to treat such work as 'extra' and to submit written claims for extra costs within thirty days. Defendant appealed the trial court's award of recovery to plaintiff. Plaintiff, contending defendant's actions constituted waiver of the contractual requirements, cross-appealed, denying the adequacy of its award. The Appellate Court of Illinois held that the sanitary district's approval of changes in sewer construction methods and material did not constitute waiver of contractual conditions requiring written consent to extra costs for unauthorized work due to allegedly unforeseen subsurface conditions. Finding the plaintiff had been forewarned of possibly adverse subsurface conditions by both the contract and bid proposal, the court ruled the defendant not liable for plaintiff's extra costs. The lower court's award to plaintiff was reversed. (Earl-Florida)
W71-04660

HENRY B BYORS AND SONS, INC V BOARD OF WATER COMM'RS (VALIDITY OF CHARGES IMPOSED AS A PRECONDITION TO MUNICIPAL WATER SERVICES).

264 NE2d 657-664 (Mass 1970).

Descriptors: *Massachusetts, *Water demand, *Water pressure, *Water rates, Water costs, Water supply, Contracts, Water distribution (Applied), Water conveyance, Distribution, Domestic water, Institutional constraints, Permits, Installation costs, Administration, Administrative agencies, Land tenure, Public utilities, Legal aspects, Judicial decisions.

Plaintiff plumbing subcontractor sought a judicial determination of the validity of, and liability for, a charge imposed by defendant municipal water commissioners as a condition precedent to providing water services. The charge was imposed to meet the costs of maintaining adequate water pressure and supply in light of the cumulative effect of new construction. Plaintiff contended the charge was unauthorized, unreasonable and discriminatory, and denied liability under a contract requiring him to pay all necessary costs. Defendants asserted that such a 'demand charge' was within their statutory authority. The Supreme Judcial Court of Massachusetts held that: (1) municipal water commissioners have the authority to demand a charge before allowing connections into a municipal water main; (2) water charges need not be based entirely on the amount of water used; (3) reasonable discretion may be exercised in determining the terms of an extension of municipal water lines; (4) absent controlling contractual stipulations, a property owner is liable for water service and related charges. The court decreed the defendants' charge to be reasonable and valid. However, the property owner and not plaintiff subcontractor was liable for the payment of the charge. (Earl-Florida)
W71-04661

SISSELMAN V SMITH (AUTHORITY OF COAST GUARD TO ISSUE BRIDGE-CONSTRUCTION PERMITS).
432 F2d 750-755 (3rd Cir 1970).

Descriptors: *United States, *Bridge construction, *Permits, *Legislation, Federal jurisdiction, Administrative agencies, Administration, Administrative decisions, Federal government, Navigation, Navigable waters, Canals, Navigable rivers, Adjudication procedure, Decision making, Coast Guard regulations, Institutional constraints, Construction, Legal aspects, Judicial decisions.
Identifiers: *General Bridge Authority Act.

Plaintiff canal owners, on grounds of impairment of navigation, sought to block the issuance of bridge construction permits by defendant Coast Guard commandant. Plaintiffs' canal had been constructed under legislation reserving in Congress the right to alter its navigable use. Defendant issued the permits pursuant to the General Bridge Authority Act of 1946. Plaintiffs contended that, in light of Congresses' reserved authority under the prior statute, defendant was without authority to issue the permits. The Third Circuit Court of Appeals held that the General Bridge Authority Act was intended to end piecemeal congressional supervision of bridge construction under prior legislation and, absent contrary language in pertinent statutes, there is no right to cross examination or notice in proceedings for the issuance of bridge permits by the United States Coast Guard. Determining that sufficient evidentiary support existed to uphold the defendant's determination that the alleged impairment to navigation was more theoretical than real, the court ruled that the power reserved to Congress by the prior statute had been delegated to the defendant. Summary judgment in favor of defendant affirmed. (Earl-Florida)
W71-04662

UNITED STATES V TANKER MONSOON (RECOVERY FOR WRONGFULLY IMPOSED OIL POLLUTION CLEAN-UP COSTS).

433 F2d 95-98 (1st Cir 1970).

Descriptors: *Oil, *United States, *Water pollution, *Ships, Pollution (Stream), Stream pollution, Oily water, Navigable waters, Navigable rivers, Admiralty, Federal government, Harbors, Water pollution sources, Pollutants, Pollution abatement, Judicial decisions, Legal aspects, Legislation, Remedies.
Identifiers: *Oil Pollution Act, *Oil spills.

Plaintiff oil tanker sought recovery of oil-clean-up expenses incurred after the United States libeled her and charged her with violation of the Oil Pollution Act of 1924. Evidence at trial established that the tanker had not caused the pollution. Plaintiff alleged that the government's negligence in charging her entitled her to recovery of clean-up costs. The United States denied negligence, asserted governmental immunity, and denied the imposition of a penalty or the receipt of money. The United States Circuit Court of Appeals for the First Circuit held that where the government negligently charges a tanker with pollution and demands she clean up oil spillage or be billed for the government's expense, the tanker electing to clean up is entitled to recovery of her costs under the Tucker Act, as a penalty wrongfully exacted by the government. The court determined that there was no probable cause to charge the plaintiff, and governmental tort immunity did not apply since a negligent lawsuit is not a tort. (Earl-Florida)
W71-04663

CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (ALLEGED TAKING OF LITTORAL LANDOWNER'S PROPERTY FOR CONSTRUCTION OF BERM).

177 SE2d 513-518 (NC 1970).

Descriptors: *North Carolina, *Eminent domain, *Berms, *High water mark, Land tenure, Boundary disputes, Riparian land, Beaches, Beach erosion, Tidal effects, Shores, Low water mark, Shore protection, Sea walls, Compensation, Piers, Intertidal areas, Navigable waters, Landfills, Cities, Legislation, Atlantic Ocean, Judicial decisions, Legal aspects.

Plaintiff littoral landowner sought to recover compensation for defendant town's alleged taking of property for a public purpose. In order to protect against beach erosion, defendant had constructed a berm along the ocean in front of plaintiff's property. Plaintiff alleged that the construction caused the loss of the use of his property and a fishing pier constructed in front of it. Defendant admitted construction of the berm, but alleged that the berm was located on land which had been divested from plaintiff through prior erosion by the ocean. The Supreme Court of North Carolina affirmed a lower court's nonsuit of plaintiff. In North Carolina a littoral landowner's property right extends only to the high water mark, although he has a right of access to the sea. The high water mark is generally computed in relation to the average high tide. Evidence showed that prior to construction of the berm, erosive action had placed plaintiff's land below the high water mark. The purpose of the berm was to provide protection from the sea and not to reclaim land along the beach for private owners. Therefore, title to the land was in the state, thus precluding plaintiff from obtaining compensation. (Duss-Florida)
W71-04664

HAMBURGER V UNITED STATES (GOVERNMENTAL LIABILITY FOR SUBMERGED, INOPERATIVE SHOAL LIGHT).
318 F Supp 103-106 (D Md 1970).

Descriptors: *Federal government, *Navigation, *Buoys, *Shoals, Warning systems, Navigable waters, Hazards, Damages, Charts, Coast guard regulations, Accidents, Safety, Boats, Ships, Federal jurisdiction, United States, Judicial decisions, Legal aspects.

Plaintiff boat owner sought recovery from defendant United States for both personal injuries and property damage after striking the submerged remains of a shoal light. Defendant had marked the location of the remains with a warning light and had published a 'notice to mariners' after the shoal light's destruction was discovered. The United States District Court held that where a boat owner fails to note the absence of an aid to navigation, ignores a nearby warning light, and fails to consult available charts and notices, such actions constitute the proximate cause of any subsequent c sion with submerged remains of the absent nav tional aid. Noting the defendant had fulfilled duty to mark the remains of the submerged sh light, the court entered judgment for defend (Earl-Florida)
W71-04665

RECREATION AND FISH AND WILDL PROGRAM FOR THE STATE WATER P JECT,
California State Dept. of Water Resources, Sa mento.
For primary bibliographic entry see Field 04A.
W71-04684

KNIGHT V LEWARK (TRESPASS BY BUI ING DOCK IN BAY).

199 NC 407, 154 SE 624-625 (1930).

Descriptors: *North Carolina, *Ownership of b Bays, Docks, Beds, Beds under water, Prescrip rights, Adjudication procedure, Legal aspects, dicial decisions, Navigable waters.

Plaintiff riparian landowner sought to enjoin de dant from erecting a wharf and storehouse in bay in front of plaintiff's land. Plaintiff alle ownership of the bed of the bay. Defendant c tended that plaintiff did not own the bed. At t the jury found that defendant had not trespa upon plaintiff's land. Observing that the issu trespass was properly decided by the jury, Supreme Court of North Carolina affirmed lower court judgment for defendant. The c furthermore observed that whether plaintiff c obtain an injunction on other grounds was material, since the action was brought at law trespass. (Hart-Florida)
W71-04719

HOLT V CITY OF WESTON (LIABILITY CITY FOR REFUSAL TO EXTEND DRAINA CULVERT).
157 SE 176-177 (W Va 1931).

Descriptors: *West Virginia, *Damages, *Ci *Natural flow doctrine, Drainage, Water inj Adjudication procedure, Condemnation, Emi domain, Streams, Roads, Culverts, Surf drainage, Judicial decisions, Legal aspects.

Plaintiff landowner sought damages for defend city's alleged negligence in failing to exten drainage culvert across his land to a creek. county had built a new road adjacent to plaint tract and placed drains which altered the nat flow of surface water, causing unnatural quanti of water to flow onto plaintiff's land. Defend after its incorporation of plaintiff's land, refuse extend the drainage culverts across plaintiff's to the creek. Plaintiff asserted that he sought re ring damages for an abatable nuisance, while fendant contended that plaintiff was asserting manent damages. The Supreme Court of App of West Virginia noted that recurring dama could not be recovered from a public corporat since the injured party possessed the right receive the condemnation value for his inj However, the court determined that plaintiff tually sought permanent damages in the natur an inverse condemnation, for which the cou rather than defendant, was responsible. cordingly, the court held that the lower court properly sustained a demurrer to the compla (Hart-Florida)
W71-04730

IN RE WATER FRONT ON NORTH RIV (CONDEMNATION VALUE OF RIPARI LAND AND BEDS UNDER WATER).
219 App Div 27, 219 NYS 353-366 (Sup Ct A Div 1926).

Descriptors: *New York, *Condemnation value, Ownership of beds, *Docks, Eminent domain, Condemnation, Rivers, Beds, Beds under water, Riparian land, Riparian rights, Land tenure, Real roperty, Legal aspects, Judicial decisions, Cities, Compensation, Local governments.

Defendant reparian owner sought review of a condemnation award for his land taken in proceedings y plaintiff municipality. Defendant's condemned roperty was interposed between a street and river. nother tract across the street also belonged to defendant. Defendant asserted that: (1) compensaon should have been allowed for pier and bulkead rights; (2) use of the property for other purses should have been considered in making the ward; (3) consequential damages to the uncondemned parcels should have been allowed; and (4) owance should have been made for conjunctive e of the condemned property with the uncondemned parcel across the street. The Appellate vision of the New York Supreme Court held that mpensation should have been permitted for pier d bulkhead rights held in fee by defendant spite legislation restricting exercise of the rights. to the second contention, the court held that a downer should receive the greatest value of his operty for any purpose. In addition, the alvances given defendant for consequential nages and conjunctive use were upheld. (Hartrida)
71-04731

RE BELLEVUE HOSPITAL PSYCHOPATHIC VILION SITE IN CITY OF NEW YORK ONDEMNATION VALUE OF SUBMERGED NDS).
Misc 774, 230 NYS 411-421 (Sup Ct 1928).

scriptors: *New York, *Condemnation value, ds under water, *Riparian rights, Roads, hways, Cities, Beds, Ownership of beds, inent domain, Compensation, Payment, Judicial isions, Legal aspects, Condemnation, Land re, Easements, Usufructuary right, Cranes, s.

ntiff city brought action to condemn riparian submerged land allegedly belonging to defen-. The upland had been granted to defendant's decessor-in-title on the condition that, on ded of plaintiff, he would construct and maintain eet fronting on the submerged property. The t extended to the upland boundary of the osed street. Construction of the street was r demanded by plaintiff. Defendant contended he held an easement in the submerged properuntil such time as plaintiff sought construction of treet. Defendant therefore sought compensafor the condemnation of this easement. The eme Court of New York found that defendant but a usufruct in the property and was not en- to compensation therefor. Defendant also deled compensation for the diminished value of harfage and cranage rights. The court held since the proposed street would intervene een defendant's upland and the river, the of his wharfage rights must be reduced by the nt necessary to construct a new bulkhead and wise render utilization of the claimed rights ble. Since such costs would equal the value of age rights, no compensation was allowed for ights. (Hart-Florida)
04732

K V BEACHLAND DEVELOPMENT CO HORITY OF SECRETARY OF THE IN-OR TO RESURVEY RIPARIAN LAND).
d 699-702 (DC Cir 1927).

iptors: *Navigable rivers, *Surveys, *Adrative agencies, *Land tenure, Administraecisions, Real property, Riparian land, Mean-Boundaries (Property), Boundary disputes, aspects, Judicial decisions, Administration, l States, Federal government.

Plaintiff development company sought to enjoin defendant Secretary of the Interior from resurveying certain riparian lands. The disputed lands had been surveyed by the United States and patented to plaintiff's predecessor. An interloper settled upon the land and applied to defendant for a survey, claiming that the lands were public and asserting his claim as a settler. Defendant's agent investigated the situation, and concluded that the original survey and meander were erroneous. However, other supervisory agents concluded that the original surveys were reasonably accurate and therefore resurvey was unnecessary. Nevertheless, defendant directed a new survey. Determining that defendant had no authority to resurvey lands which had already been conveyed by the United States, the Court of Appeals of the District of Columbia held that the original survey and its meanders were reasonably accurate and enjoined resurvey, noting that but for a contemplated township in the area, the resurvey request would probably not have been made. (Hart-Florida)
W71-04734

OFFSHORE LANDS WITHIN BISCAYNE NATIONAL MONUMENT (OWNERSHIP OF LANDS OUTSIDE STATE'S THREE-MILE LIMIT),
Office of the Solicitor (Interior), Washington, D. C. Div. of Public Lands.
David E. Lindgen.
Memorandum Opinion to the Director, National Park Service, from Office of the Solicitor, Department of the Interior, Division of Public Lands, Jan 29, 1970. 3 p.

Descriptors: *Ownership of beds, *Continental Shelf, *National monuments, *Reefs, Beds, Submerged Lands Act, Legal aspects, Judicial decisions, Legislation, Federal Government, United States, Florids, Public lands, Oceans, Natural resources, International law, Exploration, Exploitation.

Responding to a request by the director of the National Park Service, this memorandum opinion from the Division of Public Lands discusses ownership of lands within the Biscayne National Monument lying outside the state of Florida's three-mile limit. The opinion makes four conclusions. First, the state of Florida, under the Submerged Lands Act, has exclusive jurisdiction over submerged lands within the Biscayne National Monument to a distance of three miles from its coastline. Second, under the Geneva Convention on the Continental Shelf, the United States has exclusive sovereign rights in the outer continental shelf, for purposes of exploration and exploitation of natural resources, seaward of the three-mile limit. However, these rights do not encompass ownership in its usual sense. Third, the location of the boundary lines between state and federal jurisdiction have not been finally adjudicated by the Supreme Court. Litigation involving location of the boundary is now before the Court. Finally, as decided in United States v Ray, 423 F.2d 16 (5th Cir 1970), two reefs within the Monument, but outside the three-mile limit, are part of the Continental Shelf and under United States jurisdiction. (Duss-Florida)
W71-04735

SOMEBODY FOULED UP THE SEAS,
Stephen Solomon.
New Republic, Vol 163, p 21-23, Oct 31, 1970.

Descriptors: *Oceans, *Water pollution control, *Water pollution sources, *Oil wastes, Water pollution, Pollutants, Water Quality Act, Water pollution effects, Pollution abatement, Non-structural alternatives, Oily water, Ships, Transportation, Law of the Sea, Oil industry, Oil, International waters, Treaties, International commissions, International law, Regulation, Legislation.

Two international conventions aimed at curbing oil pollution on the oceans are discussed in this article. The Convention on Civil Liability for Oil Pollution Damages sets the polluter's liability at $134 per ton up to a ceiling of $14 million for each ship involved in an oil spill. The author feels that the ceiling is too low in light of the size of the new super-tankers being built and urges that the oil industry, which reaps the profits from the huge tankers, should bear the cost of damages caused by oil spills. The convention only covers oil tankers, leaving other vessels free to pollute, and excepts ship owners from liability for acts of God, war, or acts of third parties. The author proposes delaying adoption of the Convention until the drafting is complete on a new treaty imposing virtually absolute liability with much higher limits on ship owners. The Convention on Intervention on the High Seas in Cases of Oil Pollution Casualties permits nations to act on the high seas to protect their coastlines from imminent danger. An amendment to a 1954 convention prohibits oil discharge on the high seas except for a certain amount per mile. The author argues that the prohibition should be absolute and the oil industry should be required to build on-shore dumping facilities. (Liptak-Florida)
W71-04740

THE 'FINAL' WATER WELL LAW AND REGULATIONS (STANDARDS FOR WATER WELL CONSTRUCTION AND PUMP INSTALLATION),
Ground Water Resources Inst.
Durward Humes.
Water Well Journal, Vol 20, p 3-11, Jan 1966. 1 tab, 9 ref.

Descriptors: *Public health, *Well regulations, *Water wells, *Legislation, Construction, Pumps, Pumping, Standards, Regulation, Well permits, Drilling, Administrative agencies, Administration, Groundwater, Water quality, Inspection, Installation, Well casings, Artesian wells, Well screens, Excavation, Water policy, Aquifers, Percolating water, Legal aspects.

Reflecting the desire of the well-manufacturing industry to protect public health and to upgrade construction standards in the industry, the Model Water Well Construction and Pump Installation Act prescribes state regulation of the well-construction industry. This report contains the proposed law, explanatory comments accompanying important sections, and proposed model administrative regulations. Also included is a table outlining standards for the construction of wells. The general scope of the Act is to prohibit construction of wells in violation of its applicable rules and regulations. The state department of health or some other appropriate agency would administer and enforce the Act, and the department would have the powers necessary to: (1) require permission and notification in designated areas before construction of water wells, abandonment of water wells, or installation of pumping equipment in any wells; (2) inspect water wells, abandoned water wells or pump installations; (3) license water well contractors; and (4) grant exemptions from the operation of the Act. Sections cover fees, procedures for enforcement, administrative hearings, judicial review and penalties for violations. The administrative regulations define more specifically standards and procedures under the Act. (Duss-Florida)
W71-04742

ONONDAGA WATER SERVICE CO V CROWN MILLS, INC (UTILITY NEEDS TO CONDEMN ONLY AMOUNT OF WATER USED).
132 Misc 848, 230 NYS 691-704 (Sup Ct 1928).

Descriptors: *New York, *Condemnation, *Natural flow, *Condemnation value, Water supply, Legal aspects, Judicial decisions, Remedies, Damages, Eminent domain, Mills, Public utilities, Lakes, Streams, Riparian rights, Dams, Water storage, Public rights, State governments, Legislation.

Plaintiff water supply company sought to obtain by condemnation the right to withdraw six million gallons of water daily from a lake which fed a stream on which defendant operated his mills. Defendant claimed the reduction in flow would diminish the power at the mills and argued that as riparian owner he was entitled to the undiminished natural flow. The trial court ruled that a riparian owner did have the right to an unaltered flow of water past his property, but a state statute allowed condemnation of this right. Defendant also contended that the statute's language required condemnation of all of defendant's right to the flow, not merely part of it. The court noted this would mean payment as though the flow had stopped, despite the fact some water would still flow past defendant's property and the mills could still operate. The court said the language required condemnation only of the water taken. In fact, the court noted, the plaintiff under the statute could condemn the water only for public use, and since only six million gallons were needed for public use, plaintiff could not condemn more than that. The court ordered appraisers appointed. (Morris-Florida)
W71-04745

UNWILLING HOST TO UNWANTED GUEST,
Nebraska Soil and Water Conservation Commission, Lincoln.
Warren D. Fairchild.
Water Spectrum, Army Corps of Engineers, p 24-29, Winter 1970.

Descriptors: *Water policy, Legal aspects, Research and development, *Flood plains, *Floods, *Planning.
Identifiers: *Flood plain management, *Flood plain information.

Nebraska has been the victim of several disastrous floods in recent years, and consequently passed legislation which has become a model of flood plain regulation. The Nebraska Flood Plain Regulation Act delineates potential flooding areas within the flood plain, enforces zoning ordinances, and reviews and upgrades the program based on changing physical and technical conditions. Launching a new approach for the protection of communities must involve a public information program, therefore, the Nebraska Commission had sessions with city councils, used television announcements, and published pamphlets to inform the public. Possibly the most significant accomplishment growing out of the Nebraska experience has been the establishment of lines of communication among various federal and state agencies whose areas of responsibility overlap. The state legislature has not funded the Commission sufficiently, but the first steps have been taken to develop the flood plain regulation program. Also, the National Flood Insurance Program, 1968, will encourage cities to follow directions of Nebraska's flood regulation act. (Wray-Chicago)
W71-04749

SYKES V SYKES (UPPER PROPRIETOR'S RIGHT TO ALLOW WATER TO DRAIN ONTO LOWER PROPRIETOR'S LAND).

197 NC 37, 147 SE 621-622 (1929).

Descriptors: *North Carolina, *Drainage, *Surface runoff, *Riddance (Legal aspects), Relative rights, Roads, Highways, Ditches, Legal aspects, Judicial decisions, Remedies, Surface drainage, Land, Real property, Runoff, Drainage water, Surface waters, Alteration of flow, Diversion.

Defendant filled a ditch on property adjacent to a road separating his property from plaintiff's, causing surface waters to drain onto and damage plaintiff's property. Defendant contended that the road was private and that the ditch was on his property. On court instructions to find for defendant if the road was private, the jury in the trial court found for defendant. Plaintiff excepted to the instructions. The Supreme Court of North Carolina affirmed. Where a road is private, the land on either side belongs to adjoining landowners. Upper proprietors have the right to accelerate the flow of water from their land to land of lower proprietors, so long as they do not alter its natural direction of flow. In the instant case there was no evidence that the water was diverted from its natural course. Defendant was entitled to fill a ditch on his own property to facilitate drainage of his land. (Dye-Florida)
W71-04750

NORTHERN COLORADO WATER CONSERVANCY DISTRICT: A POLITICAL SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Political Science.
Stanley J. Bastian.
Master of Arts thesis, Dec 1970. 218 p, 4 fig, 8 tab, 69 ref. OWRR Project B-029-COLO (4).

Descriptors: *Systems analysis, *Administrative agencies, Decision-making, Water management, Colorado, *Water resources development, *Environment, Planning.

The Northern Colorado Water Conservancy District (NCWCD), a major water distributing agency on the East Slope of the Continental Divide in northeastern Colorado, is the focus of this study. The study treats (1) the environmental forces which generated political activity designed to provide a solution to the problem of water shortages within north-eastern Colorado, (2) the political actions which led to the formation of the NCWCD, and (3) the adaptations the NCWCD has made to imputs from its environment. The NCWCD is conceptualized and analyzed as a political system. The analysis is primarily based upon a search of the minutes of the NCWCD Board of Directors' meetings, agency reports, personal interviews, pertinent government documents, and newspaper articles relating to the structure and decision-making process of the NCWCD. This study relies heavily upon the minutes of the Board meetings for the major source of information used to analyze and characterize the NCWCD political system. The major findings indicate that formation of political systems is preceded by increasingly formal and integrated political activity designed to reduce environmental stresses that cannot be handled by existing social systems. The activities and structural characteristics of a political system are determined by the primary goals pursued and the environmental forces which threaten or facilitate their realization. Political systems pass through identifiable stages of evolutionary development. As the environment changes, the goals, activities, and structural characteristics of the systems's decision-makers are modified to permit the reduction of tension within the system and protection from external threats. (Wray-Chicago)
W71-04752

PLANNING IN LOCAL WATER ORGANIZATIONS,
Colorado State Univ., Fort Collins. Dept. of Political Science.
Julian Pineda.
A Master of Arts thesis, Dec 1970. 97 p, 12 fig, 26 tab, 57 ref. OWRR Project B-051-COLO (1).

Descriptors: *Planning, Organization, Decision-making, *Water districts, Water resources development.
Identifiers: Comprehensive planning.

The study is a comparative organizational analysis of the planning process in two types of local water distribution organizations, domestic water supply and irrigation supply. The differences and the similarities in planning behavior are examined from two perspectives: (1) the type of the organization, and (2) the size of the organization. The analysis was based upon data obtained from a ten per cent sample of each of the two types of organizations in an area of high population density. Persons who were responsible for organizational planning v contacted and interviewed. The data was sec through the use of a standardized questionn designed to measure the extent to which orgar tions engaged in planning. The findings evidenc strong linkage between the type and size of the ganizations and the patterns of organizati planning behavior. It was found that these relat ships existed along three dimensions. First, ganization type was related to organizati planning behavior. Domestic water organizat devoted more attention to organizational plan activities than did the irrigation organizati Second, organization size showed a definite r tionship to planning behavior. More attention devoted to planning in the larger irrigation domestic organizations than in smaller orgar tions. Third, a definite relationship was found exist between organization type, organization and planning behavior. (Wray-Chicago)
W71-04754

SYSTEMS ANALYSIS, WATER QUALITY A GOVERNMENT DECISION MAKING,
New York State Dept. of Health, Albany. Envi mental Health Services.
For primary bibliographic entry see Field 06A.
W71-04766

ANDERSON V MCCULLEY (DAMAGES F OBSTRUCTING SURFACE DRAINAGE).

225 NW 152 (Minn 1929).

Descriptors: *Minnesota, *Obstruction to fl *Drainage systems, *Surface drainage, Dra Ditches, Floods, Flood damage, Land, L tenure, Relative rights, Surface waters, Surface noff, Damages, Legislation, Legal aspects, Judi decisions, Crops.

Plaintiff farmer, seeking to recover damages, leged that defendant landowner had negligently structed a drainage ditch so that water was held plaintiff's land, damaging his crops. The j returned a verdict for plaintiff, and defendant pealed, challenging the sufficiency of the eviden The Supreme Court of Minnesota affirmed. evidence showed that defendant obstructed drainage ditch in disregard of plaintiff's rights, the ditch was part of a public drainage system. who negligently obstructs a public drain to damage of his neighbor is liable for damages. (M ris-Florida)
W71-04769

HOWLAND V UNION BAG AND PAPER CO (CONDEMNATION OF LAND ALONG STREA DOES NOT DEPRIVE RIPARIAN OWNER TITLE TO BED NOR RIPARIAN RIGHTS).
156 Misc 507, 282 NYS 357-367 (Sup Ct 1935).

Descriptors: *New York, *Ownership of be *Dams, *Non-navigable waters, Riparian rights, dustrial use, Damages, Remedies, Legal aspec Judicial decisions, Relative rights, Condemnati Right-of-way, Streamflow, Beds, Beds under wat

Plaintiff riparian landowner, whose predeces had condemned a strip of his property runni along a stream, sought an injunction to prevent fendant corporation from maintaining a dam acr the stream. Plaintiff contended that the condemn tion of the strip of land along the stream, when h by his predecessor, did not divest his predecessor title to the streambed. Plaintiff thus contended t defendant had no right to maintain a dam acr the stream. Defendant contended that it h acquired title to both the right-of-way and t streambed from its predecessor. The court he (1) that the condemnation of the right-of-way not deprive the riparian landowner of title to t bed; (2) plaintiff's predecessor had title to the b because grants of land bounded by a stream conv the bed to the center of the stream; and (3) plaint was entitled to have the stream flow past his ripa

an property in its natural condition. Plaintiff could have the dam removed if he could show substantial damage. (Quesada-Florida)
W71-04776

BAILEY V UNITED STATES (LIABILITY OF UNITED STATES FOR PRESIDENT'S ULTRA VIRES CONDEMNATION OF OYSTER BEDS).
62 Ct Cl 77-96 (1926).

Descriptors: *Oysters, *Beds under water, *Condemnation, *United States, Leases, Federal government, Eminent domain, Compensation, Payment, Beds, Ownership of beds, Low water mark, Intertidal areas, Navigation, Judicial decisions, Legal aspects, Remedies.

Plaintiff lessee of oyster beds sued defendant United States for compensation for the taking of oyster beds. Plaintiff had leased oyster beds below low water mark from the state and had planted oysters. Pursuant to congressional legislation authorizing condemnation only to the low water mark, the President condemned plaintiff's lands for use as a naval base. Bulkheads were emplaced and the lands were filled. Defendant refused to compensate plaintiff. Since defendant's lease was below low water mark, the court concluded that the taking was ultra vires. Hence the court held that plaintiff possessed no rights within the authorized taking, nor without it, since an agent could not bind the United States to pay for an unauthorized taking. Plaintiff also contended that defendant's acts were not in exercise of navigational improvements, but the court observed that a naval base intrinsically involved navigational improvements. Accordingly, plaintiff was held unable to recover. (Hart-Florida)
W71-04777

LABAMA POWER CO V SMITH (POWER OMPANY'S LIABILITY FOR DAMAGE ESULTING FROM DAM OPERATIONS).
55 So 601-612 (Ala 1934).

escriptors: *Alabama, *Dams, *Federal Power ct, *Discharge (Water), Electric powerplants, idges, Federal government, Legislation, Legal pects, Judicial decisions, Adjudication ocedure, Structures, Reasonable use, Navigable ers, Reservoir operation, Reservoirs, Relative hts, Facilities, Damages, Backwater, Precipitan excess, Flow control, Water control, Water rage.

aintiff was engaged in constructing a bridge in a er downstream from defendant power comny's dam. Without warning plaintiff, defendant eased an unusual amount of water on one occan to accomodate waters from a heavy rainfall. aintiff's construction was damaged severely by water. Plaintiff sought damages, contending t: (1) defendant's agent orally agreed to notify intiff of any unusual occurrence, (2) defendant eased the water with knowledge of the damage bable to plaintiff's construction, and (3) liabilifor such damage was imposed by the Federal ter Power Act. In reversing a judgment for intiff, the Supreme Court of Alabama held that Water Power Act merely provided for a power nsee's assumption of liability otherwise existing. gligence must still be shown. Power companies not insurers for damage occurring downstream a result of plant operations. There was no dence of consideration supporting the purported eement to notify plaintiff. Defendant's liability t rest on proof of negligence, a knowing release ater with probable damage to plaintiff. (Dyeida)
1-04779

E OUTER CONTINENTAL SHELF--MANAG- (OR MISMANAGING) ITS RESOURCES,
rge Miron.
nal of Maritime Law and Commerce, Vol 2, 2, p 267-288, Jan 1971. 22 p, 58 ref.

Descriptors: *Continental Shelf, *Resource development, *Exploration, *Expolitation, Administrative agencies, Administration, Legislation, United States, Federal government, State governments, Environment, Environmental effects, Leases, Permits, Public rights, Mineralogy, Oil, Oil industry, Oil waste, Marine geology, Oceans, Conservation, Evaluation, Geological survey, Treaties. Identifiers: *Outer Continental Shelf Lands Act, *National Environmental Policy Act.

It is contended that the United States at present is mismanaging the resources of the Outer Continental Shelf. The Outer Continental Shelf Lands Act has extended United States jurisdiction to the Shelf for purposes of exploration and exploitation of resources and vests most of the responsibility for administering the Shelf in the Secretary of Interior. The author argues that there have been two principal failings in the administration of this Act. The first is an absence of environmental safeguards in the procedures for permitting exploration of the Outer Continental Shelf. The second is mismanagement of Shelf mineral exploitation. In the area of environmental protection the author finds that there is insufficient public participation in the permit procedure and a failure to obtain exploration data from permittees. As for mineral exploitation, the Department of Interior has followed an imprudent leasing strategy and permitted the control of output to be accomplished through state proration systems, which increases costs by setting quotas of production to wells regardless of their output potential. The author offers recommendations for improving the administration of Shelf resources. (Duss-Florida)
W71-04781

RECENT DEVELOPMENTS IN THE LAW OF THE SEAS: A SYNOPSIS,
Michael B. Harris, and Anthony Lovett.
San Diego Law Review, Vol 7, No 3, p 627-673, July 1970. 47 p, 68 ref.

Descriptors: *Oceans, *Legal aspects, *Water pollution, *Law of the sea, Judicial decisions, Legislation, Water resources development, International law, Admiralty, Administrative agencies, Administrative decisions, Water pollution effects, Water pollution control, Water pollution sources, Pollution abatement, United States, State governments, Oil, Wildlife, Zoning, Ships, Navigable waters, Navigation, Mineralogy, Fishing, Conservation.

This compilation of summaries of legal developments in the law of the seas between July 1, 1969, and March 15, 1970, covers the following areas: (1) conservation, both domestic and international; (2) fishing; (3) minerals; (4) navigable waters; (5) pollution, including domestic-inland, domestic-coastal, and international pollution; (6) salvage; (7) shipping; (8) sovereignty, including sections on jurisdiction and on the Northwest Passage; (9) water; (10) wildlife; and (11) zoning. The developments summarized include comments on enacted legislation, case law, meetings, conventions, executive proposals, and treaties. For example, the section discussing navigable waters includes a note on a federal district court decision regarding United States condemnation of a Maryland island and a comment on another federal district court decision regarding the contest of the Army Corps of Engineers' denial of an offshore dredge and fill permit in Florida. The section on domestic-coastal pollution comments on: (1) the Santa Barbara oil spill aftermath; (2) the ACLU suit to enjoin oil drilling in the Santa Barbara channel; (3) new leakage in the Santa Barbara channel; (4) a criminal action against oil companies involved in the Santa Barbara channel oil spill; and (5) proposed legislation banning oil drilling in the channel. (Hart-Florida)
W71-04782

A LEGAL REGIME FOR DEEP SEA MINING,
Ocean Resources Inc., La Jolla, Calif.
John L. Mero.
San Diego Law Review, Vol 7, No 3, p 488-503, July 1970. 16 p, 26 ref.

Descriptors: *International law, *Mineralogy, *Oceans, *Law of the sea, United Nations, Foreign countries, Governments, United States, Mineral industry, Continental Shelf, Oceanography, International waters, Water pollution control, Exploration, Exploitation, Legal aspects, Water pollution.

Since the magnitude of the mineral resources of the sea is enormous, deep sea mining is a crucial factor in world development. However, only a few nations possess the technological capability to exploit deep sea minerals. Anomalously, these minerals have been termed the 'common heritage of mankind.' To ensure that this 'common heritage' inures to all people this article proposes a legal regime to control development of deep sea mining. The author notes that a legal regime is necessary to control pollution. Before outlining the proposed regime, the author describes the nature of deep sea deposits and their potential to world society. First, he discusses the jurisdiction of riparian nations in the oceans, established by the Geneva Convention. The spectrum of minerals available in seafloor nodules is examined in detail. A timetable for deep sea mining is proposed. A leasing agency, operated by the United Nations and having largely administrative functions, is suggested as the beginning of a legal regime to control deep sea mining. After establishment of the agency, the author proposes a code of laws allowing technically and financially competent nations to claim limited portions of the ocean floor. The laws would prevent interference with other ocean uses. (Hart-Florida)
W71-04783

THE CONTROL OF POLLUTION BY OIL UNDER THE WATER QUALITY IMPROVEMENT ACT OF 1970,
Washington and Lee Univ., Lexington, Va. School of Law.
For primary bibliographic entry see Field 05G.
W71-04784

WILLIS V BOYD (VALIDITY OF MINING LEASE IN RIVER BED).

224 KY 732, 7 SW2d 216-218 (1928).

Descriptors: *Kentucky, *Navigable rivers, *River beds, *Leases, Ohio River, Banks, Islands, Ownership of beds, Legislation, Local governments, State governments, Legal aspects, Judicial decisions, Excavation, Sands, Gravels, Mining, Steamboats, Boundaries (Property).

Plaintiff brought action to enjoin defendant from removing sand and gravel from the bed of the Ohio River. Plaintiff contended that he had an exclusive 50-year lease to remove sand and gravel from the river bed. Defendant contended that the statute authorizing the lease was invalid as in conflict with statutes limiting the acreage that the state and counties could patent to private parties. Moreover, defendant contended that the statute conflicted with the consitutional prohibition against legislation. The court noted that the limit on saleable acreage did not apply to leases of mining rights, that the statute could not affect any private property, and that the act was of general application although only affecting the Ohio River. However, the court reversed a lower court judgment for plaintiff, holding that the rights granted by the lease were profits a prendre and could only be granted at public auction and only for 20 years. (Liptak-Florida)
W71-04785

THE SETTLEMENT OF DISPUTES BETWEEN FEDERAL AND STATE GOVERNMENTS CONCERNING OFFSHORE PETROLEUM RESOURCES: ACCOMMODATION OR ADJUDICATION,
John L. Taylor.
Harvard International Law Journal, Vol II, p 358-399, 1970. 42 p, 205 ref.

Descriptors: *Beds, *Ownership of beds, *Continental Shelf, *Boundary disputes, Boundaries (Property), International waters, Interstate compacts, Oil, Federal government, State governments, Inland waterways, Judicial decisions, Legal aspects, Submerged Lands Act, Coasts, Gulf of Mexico, Great Lakes, Political aspects.

The increasing demand for petroleum has initiated an ongoing dispute between state and federal governments with regard to the ownership of offshore lands and the petroleum deposits therein. The author of this article assumes an international perspective in making a comparative examination of the ownership dispute in the United States, Canada, and Australia. A brief analysis is made of the problems and contrasting modes of dispute-settlement in each jurisdiction. The procedures examined are those of accommodation and adjudication. A constitutional and historical background is given in an effort to elucidate the practicality and efficacy of dispute-settlement procedures. The author concludes with a jurisprudential discussion of dispute settlement and his suggestions for reaching a satisfactory result. The author recommends settlement of such disputes by the political arm of government. In the opinion of the author, judicial settlement should be resorted to only when political solutions fail. (Barnett-Florida)
W71-04786

SURFACE WATER CONTROL IN NEW JERSEY, PART II: DRAINAGE, FLOOD CONTROL AND RELATED POLICIES IN AN URBAN STATE.
Rutgers-The State Univ., New Brunswick, N.J. Bureau of Government Research.
For primary bibliographic entry see Field 04A.
W71-04787

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.

42 USCA secs 4321 thru 4335, 4341 thru 4347 (Supp 1970).

Descriptors: *Environment, *Administrative agencies, *Environmental effects, *Federal project policy, Legislation, Federal government, Ecology, Environmental gradient, Environmental sanitation, Administration, Adoption of practices, Decision making, Operations research, Project planning, Legal aspects, Leadership, Administrative decisions, Coordination, International waters.
Identifiers: *National Environmental Policy Act.

This National Environmental Policy Act of 1969 establishes a Council on Environmental Quality and declares that the federal government will use all practicable measures to improve the national environment. Federal agencies are directed to cooperate with each other and with the Council on Environmental Quality. Every recommendation or report made by an agency must include: (1) the environmental impact of the proposed action, (2) unavoidable adverse environmental effects, (3) alternatives to the proposal, (4) the relationship between short-term use and long-term productivity, and (5) irretrievable resource committments should the proposal be implemented. Agencies are required to recognize international environmental problems and support programs to prevent deterioration of the world environment. The President shall transmit an annual report on the state of the environment to congress and shall provide a program for remedy of environmental deficiencies. The Council on Environmental Quality is composed of three qualified members appointed by the President. It must: (1) assist the President in preparing his report to Congress, (2) monitor the national environment, (3) appraise federal programs in light of the environment, (4) conduct environmental research, (5) document environmental changes, (6) report to President annually on the environmental condition, and (7) make such other reports as the President requests. (Hart-Florida)
W71-04788

ESTABLISHMENT OF THE OHIO RIVER BASIN COMMISSION.

Exec Order No 11578, Federal Register, Vol 36, No 11, p 683-684, Jan 16, 1971. 2 p.

Descriptors: *Water Resources Planning Act, *River basin development, *River basins, *Administrative agencies, River basin commissions, Land resources, Drainage, Ohio, State governments, Tennessee River, Federal government, Administration, Interstate compacts, Interstate commissions, Planning, Water resources development, Interstate.
Identifiers: *Executive orders.

Pursuant to the Water Resources Planning Act (79 Stat. 244, 42 U.S.C. 1962 et. seq.), which provides for the establishment of river basins, water and related land resources commissions, the President of the United States, Richard Nixon, established the Ohio River Basin Commission. This Commission shall have jurisdiction in those portions of the states of Kentucky, Illinois, Indiana, Maryland, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia that are located within the Ohio River drainage basin, excluding the Tennessee River drainage basin. The Commission shall consist of: (1) a chairman, appointed by the President; (2) one member from each of several federal departments and agencies; (3) one member from each of several selected states within the affected areas; and (4) one member from each interstate agency created by an interstate compact whose jurisdiction extends to the waters of the area specified. The duties of these members shall be executed in accordance with the provisions of the Water Resources Planning Act. (Barnett-Florida)
W71-04789

DELAWARE RIVER BASIN COMMISSION CHARGES FOR WATER SUPPLY.
Delaware River Basin Commission, Trenton, N.J.

Federal Register, Vol 36, No 9, p 566-567 (Jan 14, 1971). 2 p.

Descriptors: *Administrative agencies, *Delaware River Basin Commission, *Water supply, *Water rates, Water users, Water demand, Water distribution (Applied), Federal government, Water costs, Water management (Applied), Water storage, Water quality, Contracts, Legal aspects, Administration, Costs, Operation and maintenance, Cities, Non-consumptive use, Pumping, Pumping plants, Administrative decisions, Diversion.

Notice is published herein that the Delaware River Basin Commission will hold a public hearing on Thursday, January 28, 1971, for discussion of a proposed resolution of policy to develop a rate basis for settling charges to users of water supplied by the Commission. Since: (1) revenues from the sale of water have been authorized as a means of repaying the non-federal share of the federal investment cost of water supply storage facilities, and (2) the Commission requires further policy to develop a fair and defensible rate basis for setting charges to users, the Commission has resolved to implement a five step plan for the imposition of water use charges. The proposed plan is reproduced in full. Those wishing to testify as to the plan are requested to register in advance. Also, public notice is established regarding the availability of a draft report (in accordance with the National Environmental Policy Act of 1969) discussing the environmental impact of a proposed pumping plant on the Delaware River at Point Pleasant, Pennsylvania. (Barnett-Florida)
W71-04790

DEBATE AND HOUSE PASSAGE OF THE WATER BANK ACT.
116 Cong Rec 9556-9561 (daily ed, Oct 5, 1970).

Descriptors: *Wetlands, *Wildlife habitats, *Legislation, *Water conservation, Flood protection, Flood control, Water resources, Water contracts, Soil erosion, Wind erosion, Surface runo
Surface waters, Drainage practices, Fede
government, Federal project policy, Reservoi
Land resources, Non-structural alternatives, S
surface waters, Scenery, Land tenure, Real prop
ty, Waterflowl, Economic impact, Economics, W
dlife conservation.
Identifiers: *Water Bank Act.

The text of the Water Bank Act (H.R. 15770), a
dorsements of the Act by leading conservationi
and a discussion of the Act on the House floor
contained in this portion of the Congressio
Record. The objectives of the Act are described
(1) preservation of surface waters, (2) preservati
and improvement of habitats for migratory wat
fowl and other wildlife; (3) reduction of flood
noff and soil erosion, and (4) flood control. The
objectives are to be accomplished through gover
ment compensation to landowners who agree
to drain, burn, fill, or otherwise destroy wetlands
which they hold title. The view is expressed that t
Act will present landowners with an economic
ternative to the increasing drainage of wetlan
Dividends to be derived under the Act, in the vi
of one Congressman, include: (1) a recharging
underground water supplies, (2) the preservati
of surface reservoirs, (3) increased flood prote
tion, (4) protection of the ecological balance, a
(5) preservation of natural beauty. Upon the co
clusion of discussion, the Water Bank Act w
passed, as amended, by a two-thirds vote of t
House. (Earl-Florida)
W71-04791

**FINANCIAL RESPONSIBILITY FOR OIL PO
LUTION CLEANUP (EXEMPTION OF NO
SELF PROPELLED BARGES FROM FINA
CIAL RESPONSIBILITY REQUIREMENTS).**
Federal Maritime Commission, Washington, D.C.

Federal Register, Vol 36, p 834-835 (Janua
1971). 2 p.

Descriptors: *Water pollution control, *O
*Ships, *Rivers and Harbors Act, Insuranc
Federal government, Water pollution, Water poll
tion sources, Legislation, Water law, Legal aspect
Risks, Compensation, Pollution abatement, A
ministration, Administrative agencies, Fuels.
Identifiers: *Administrative regulations, *Feder
Water Pollution Control Act.

The Federal Water Pollution Control Act requir
every vessel over 300 gross tons to maintai
evidence of financial responsibility to meet any li
bility to the United States resulting from th
discharge of oil into United States waters. Th
River and Harbor Act of 1970 amended th
Federal Water Pollution Control Act to exclud
from the financial responsibility requirements
the Act 'any barge that is not self-propelled an
that does not carry oil as cargo or fuel.' Pursuant t
that amendment, the Federal Maritime Commi
sion proposes to amend its regulation concernin
maintaining and providing evidence of financi
responsibility. New definitions are added, definin
'cargo' as including both proprietary and no
proprietary cargo, and 'fuel' as any oil capable
being burned for heat or power. (Liptak-Florida)
W71-04792

**CERTIFICATION OF FACILITIES (PROPOSE
REGULATIONS FOR CERTIFYING POLLU
TION CONTROL FACILITIES FOR TA
DEDUCTION PURPOSES).**
Environmental Protection Agency, Washington
D.C.

Federal Register, Vol 35, p 19686-19688 (De
1970). 3 p.

Descriptors: *Pollution abatement, *Treatmen
facilities, *Administration, *Taxes, Water pollu
tion, Water pollution control, Air pollution, Wate
pollution treatment, Public health, Wastes, Wast
disposal, Waste treatment, Conservation, Adminis

trative agencies, Regulation, Standards, State governments, Federal government, Government supports, Clean Air Act, Tax rate.
Identifiers: *Water Pollution Control Act, *Administrative regulations.

To insure consistency and uniformity in the implementation of section 704 of the Tax Reform Act, he functions of other agencies concerning certifiation of water pollution control facilities and air ollution control facilities were transferred to the dministrator of the Environmental Protection gency. The Administrator proposed combined egulations regarding certification of air and water ollution control facilities for tax deduction purposes. All applications will be filed with the state ertifying agency, which will forward the applicaon and the state certification to the Administra. The Administrator will not certify a facility ior to completion but may give notice of intent to ertify provided the completed facility conforms to e applicable air or water quality standards. Applitions shall contain specified data including a escription of the proposed facility and its funcn, cost, and expected useful life. Federal policy to cooperate with the states to enhance the quali and value of air and water resources. To be ceried, a facility must: (1) control pollutants which ould otherwise be released into the environment,) not be part of the manufacturing process, (3) eet all state and federal air or water quality stanrds, and (4) not recover its own cost through ofits from recovered waste products or otherse. (Liptak-Florida)
71-04793

EXECUTIVE ORDER 11574 (ADMINISTRATION OF REFUSE ACT PERMIT PROGRAM).

deral Register, Vol 35, p 19627-19628 ecember 1970). 2 p.

scriptors: *Waste disposal, *Navigable waters, dministration, *Permits, United States, Federal vernment, Administrative agencies, Regulation, ter pollution, Water pollution control, Abatent, Pollutants, Wastes, Effluents, Waste water llution), Water quality, Water quality control, gislation, Rivers and Harbors Act, Coordination, vironment, Alteration of flow.
ntifiers: *Executive orders, National Environtal Policy Act.

furtherance of the policies and purposes of the deral Water Pollution Control Act, the Fish and dlife Coordination Act, and the National Enonmental Policy Act, President Nixon ordered executive branch to implement a permit pron to regulate the discharge of pollutants and er refuse into the navigable waters of the United es. The Secretary of the Army is ordered, after sulting with the Administrator of the Environtal Protection Agency, to adopt regulations procedures for processing permit applications. Secretary has the responsibility for granting, ying, revoking, or suspending permits, but must ept the findings of the Administrator as to the ct on applicable water quality standards. A perwill be denied where state certification under Federal Water Pollution Control Act is denied. he proposed discharge impounds, diverts, ens, or otherwise alters a water body, the etary is to consult the Secretary of the Interior, etary of Commerce, the Administrator, and state wildlife resource agency regarding effects sh and wildlife. The Secretary may make any opriate consultations not specified if required e National Environmental Policy Act, and the rney General shall conduct legal proceedings nforce the permit program. Policies and edures of the several agencies under the perrogram will be coordinated by the Council of ronmental Quality. The Council will keep the dent advised on the implementation of the ram. (Liptak-Florida)
-04794

YORK COVE CORP V UNITED STATES (LIABILITY FOR DREDGING OPERATIONS INCIDENT TO IMPROVEMENT OF NAVIGATION).

317 F Supp 799-813 (Ed Va 1970).

Descriptors: *Federal government, *Navigable waters, *Dredging, *Navigation, Damages, Federal jurisdiction, Land tenure, Oysters, Leases, Commercial shellfish, Relative rights, Piers, Regulation, Beds, Real property, State jurisdiction, Navigable rivers, United States, Beds under water, Ownership of beds, Water pollution, Legal aspects, Judicial decisions, Remedies.

Plaintiff oyster-ground lessees sought compensation from defendant United States and its dredging contractor for damages to oyster beds. Plaintiff contended that defendant contractor, in repairing a naval pier, had negligently deposited spoil in a navigable channel near plaintiff's beds. Plaintiff held his lease under a state grant in an area previously ceded to the United States. Defendants asserted that dredging operations were incident to improvements in navigation and denied negligence. As to defendant United States, the United States district court held that: (1) the federal government may assert the doctrine of dominant navigational servitude as a defense to allegedly negligent dredging incident to the construction of a naval pier; (2) governmental supervision of allegedly negligent dredging does not invoke liability under the Federal Tort Claims Act, (3) a state is without jurisdiction to lease rights in underwater lands ceded to the United States, and (4) only the Secretary of the Navy is empowered to relinquish federal interests in submerged lands under naval jurisdiction. Determining that the United States had validly asserted the defense of navigational servitude, the court ruled that plaintiff had failed to prove defendant contractor's negligence, since the evidence was just as convincing that a severe storm had caused plaintiff's injury. (Earl-Florida)
W71-04815

WILD AND SCENIC RIVERS ACT.
16 USCA secs 1271 thru 1287 (Supp 1969).

Descriptors: *Legislation, *Wild rivers, *Administration, *Conservation, Rivers, River systems, Recreation, Scenery, Water policy, Administrative agencies, Administrative decisions, Federal government, Federal project policy, Hydroelectric project licensing, Permits, State governments, Water pollution, Water pollution control, Eminent domain, Condemnation, Compensation.

In the Wild and Scenic Rivers Act, Congress declares that certain rivers shall be protected and preserved in their original condition. Rivers are categorized as: (1) wild, accessible only by trial; (2) scenic, accessible by trail generally, and by road over portions; and (3) recreationa, readily accessible by road or railroad. Eight rivers are named as components of the national wild and scenic rivers system, to be administered by either the Secretary of Agriculture or Interior. Either Secretary may propose additions to the system by making a report to the President and Congress. Reports must be coordinated with other affected agencies and published in the Federal Register. Twenty-seven other rivers are designated as potential additions to the system; the Secretaries of Interior and Agriculture are directed to study each to determine the advisability of including it in the system. Limited power of condemnation is provided both secretaries to acquire land along the rivers. The Federal Power Commission is directed not to authorize construction of any power facility on a river which is a component of the system or any facility directly affecting a component river. Further, the Federal Power Commission is admonished not to authorize any project for five years on a river which is a potential component unless it is concluded that the river will not be included in the system. Cooperation with local government is solicited. (Hart-Florida)
W71-04819

MONSANTO CO V EDWARDS TOWING CORP (DAMAGES TO DOCK FACILITY CAUSED BY BREAKAWAY OF MOORED BARGES).
318 F Supp 13-17 (ED Mo 1969).

Descriptors: *Docks, *Damages, *Ships, *Admiralty, Wharves, Rivers, Mississippi River, Missouri, Water levels, Judicial decisions, Legal aspects, Adjudication procedure, Navigable waters, Water level fluctuations, Fluctuation.

Plaintiff company brought suit against defendant towing company for damages to its dock facility. Four barges broke loose from a load fleet operated by defendant and struck plaintiff's dock. Defendant denied any negligence and filed a third-party complaint against another towing company which had tied two of the barges, alleging that the third party failed to adequately secure defendant's barges. The second towing company denied any negligence and filed a third-party complaint against a company whose vessel had passed the barges immediately prior to the breakaway, alleging that the vessel passed at an unreasonable speed and in close proximity to defendant's barges, causing the breakaway. The federal district court found against the original defendant. The burden is upon a drifting vessel to show her freedom from negligence. Defendant, as a bailee, had the duty of caring for barges in its custody. A breakaway establishes a prima facie case of negligence against the operator of the moving vessel. Defendant was informed of a coming rise in the river which would require a change in mooring yet did nothing. No evidence indicated that the second towing company improperly moored the two barges or that the passing vessel generated a swell which would have caused the breakaway. (Duss-Florida)
W71-04820

WATERFOWL AND MIGRATORY BIRDS (REGULATION AND LICENSING OF WATERFOWL HUNTING).
Maryland Code Ann art 66 C, secs 150 thru 155, 157, 159, 161 thru 162 A, 164 thru 165 (Supp 1970).

Descriptors: *Maryland, *Legislation, *Hunting, *Waterfowl, Game birds, Migratory birds, Recreation, Small game, Wildlife, Wildlife conservation, Wildlife management, Regulation, Permits, Riparian land, Riparian water, State governments, Boats, Tidal waters, Fishing, Legal aspects.

The hunting of any wild water fowl shall be illegal in Maryland and except on dates set by federal regulation or the State Department of Game and Inland Fish. Hunting is prohibited on Sundays and hunting of protected waterfowl is illegal. Waterfowl may be hunted only with shotguns under ten gauge and long bows and arrows; all other weapons are prohibited. Sneak boats and body booting rigs may be licensed, and riparian owners have special licensing rights. Hunting by boat is forbidden. Shoreline distance requirements and application dates must be followed by riparian owners seeking to license blind sites. It shall be unlawful to set out grain to lure game birds; violators may be fined or imprisoned. Named counties are exempt from blind site distance requirements. The clerks of the circuit courts are to issue licenses and to collect the fees established herein upon proper application and certification for the specified dates. Blind sites shall be subject to inspections and licenses may be revoked for violations of the Act. Certain distances must be maintained between blind sites by property owners seeking to license sites in front of their property. Trespassing on another's blind and fishing within 500 yards of a blind are prohibited and licenses are required for operation of hired hunting boats. Penalties are provided for violators where specific penalties are not otherwise specified. (Liptak-Florida)
W71-04822

UNITED STATES V 8,968.06 ACRES OF LAND (VALUATION OF RIPARIAN LAND IN EMINENT DOMAIN PROCEEDINGS).
318 F Supp 698-704 (SD Tex 1970).

Descriptors: *Federal government, *Riparian land, *Eminent domain, *Condemnation value, Navigable rivers, Value, Property values, Appreciation, Depreciation, Land appraisal, Evaluation, Reservoirs, Riparian rights, Federal jurisdiction, Riparian waters, Condemantion, Real property, Land tenure, Legal aspects, Judicial decisions, Relative rights, Remedies.
Identifiers: *Constitutionality.

In eminent domain proceedings condemning land for a reservoir project intended to improve navigation, plaintiff United States sought to exclude evidence of land value arising from access to or utilization of navigable waters. Defendant riparian owner of agricultural land sought to establish the land's potential value as a channel-cut subdivision wherein all lots would have frontage on man-made channels. Defendant contended that depreciative consequences of the riparian location, such as the possibility of flooding, should be excluded in valuing the land. The United States district court held that under the doctrine of dominant navigational servitude a riparian owner of condemned land may not show potential land value arising from non-passive utilization of and access to navigable streams. However, value which is attritutable to mere passive proximity to navigable waters is compensable. Evidence of the depreciative consequences of the riparian location is admissible. The test for determining what potential land use may be shown is whether such use may be prohibited or destroyed by the United States without creating a consitutional duty to compensate. The court held riparian owners are not entitled to receive compensation or restrain injury incurred incident to navigational improvements. Plaintiff's motion was granted. (Earl-Florida)
W71-04829

COASTAL WATERS AND THE NATION,
National Council on Marine Resources and Engineering Development, Washington, D.C.
Edward Wenk, Jr.
Civil Engineering, Vol 39, No 6, p 52-55, June 1969.

Descriptors: *Water pollution control, *Federal government, *Coasts, *Resources.
Identifiers: *Planning for multiple use.

Most of the nations population and industry are on the coasts. Recreation, maritime trade, fish and crustacean industry, offshore oil and gas industry are all coastal activities. The coastal area as a resource is diminishing rapidly due to marshland filling, waste disposal, oil seepage and tanker accidents. Planning which rationally weighs the demands for development against esthetic and natural resources is needed. The federal government is undertaking studies and considering state managed Coastal Zone Authorities for planning and regulating land and water use. The states have legal jurisdiction over most coastal resources but need better coordinated and stronger agencies. (Ensign-PAI)
W71-04831

AN ACT RELATING TO WATER POLLUTION CONTROL.

Laws of Vermont, No 252, Public Acts, 1969 Adjourned Session, p 252-264 (1970). 13 p.

Descriptors: *Vermont, *Legislation, *Administrative agencies, *Water pollution control, Water pollution, Water pollution sources, Water pollution effects, Water resources, Pollutants, Pollution abatement, Permits, State governments, Legal aspects.

This legislation categorizes all Vermont waters into two classes. Class A waters are: (1) waters of lakes, ponds, or reservoirs used for public water supply and (2) water flowing into these waters. Class B waters are all other waters. The following factors are used to classify degree of water quality to be required of water classes: (1) existing water quality; (2) existing or potential water uses; (3) natural sources of pollution; (4) public and private pollution sources; (5) need for mixing zones; (6) existing and potential use of waters for public water supply, recreational, agricultural and other uses; (7) suitability of waters as habitats for fish and wildlife; (8) need for minimum stream flow; (9) federal requirements for classification and management; (10) municipal, regional, and state plan; and (11) any other relevant factors. The act prohibits discharge of any material into state waters without a permit. Temporary permits may be issued. A permit allowing the discharge of material into waters of the state will be denied where the discharge would reduce the quality of the water below the level established for its classification. (Hart-Florida)
W71-04832

WATERS AND WATER SUPPLY--SEWERS--USES.
New Jersey Session Law Service, Chapter 91 (1970), amending New Jersey Revised Stat, Sec 58:12-3 and Supplementing New Jersey Revised Stat, Tit 58, Ch 12.

Descriptors: *New Jersey, *Legislation, *Water pollution, *Sewers, Remedies, Administrative agencies, Pollution abatement, Pollutants, Water pollution control, State governments, Non-structural alternatives, Legal aspects, Sewage disposal, Cities, Drainage, Drainage systems, Wastes.

This amended statute prohibits any person, corporation, or municipality from building or using a sewer or drainage system which discharges pollutants into state waters without approval by the state Department of Health. Violation of the law sujects the offender to a fine of at least $1000 and not more than $3000. If the violation is continuous, each day will constitute a separate violation. (Hart-Florida)
W71-04833

ENVIRONMENTAL QUALITY IMPROVEMENT.
42 USCA secs 4371 thru 4374 (Supp 1970).

Descriptors: *Legislation, *Environment, *Federal government, *Administrative agencies, Ecology, Conservation, Contracts, Legal aspects, Water policy, Administration, United States, Natural resources, Natural resources development.

The Environmental Quality Improvement Act of 1970 was enacted to implement the national policy of enhancing the environment. The legislation has two purposes: (1) to assure implementation of the national environmental policy by federal agencies; and (2) to authorize an Office of Environmental Quality. The Chairman of the Council on Environmental Quality is designated director of the Office. A deputy director is appointed by the President. The duties of the director are: (1) to provide the staff and support for the Council on Environmental Qualtiy; (2) to assist federal agencies in appraising the effectiveness of federal projects affecting environmental policy; (3) to review the adequacy of existing systems for monitoring and predicting environmental changes; (4) to promote advancement of scientific knowledge of the environment; (5) to assist in coordinating environmental activities of federal agencies; (6) to assist federal agencies to develop environmental quality standards; and (7) to collect and analyze information on environmental quality. The director is authorized to contract with public or private agencies in performing his duties. Environmental quality reports are to be referred to a standing congressional committee. Appropriations for the office through 1973 are established. (Hart-Florida)
W71-04834

TRUMBULL V MCINTOSH (FILLED LAND SUBJECT TO PRIOR MORTGAGE OF UPLAND).
138 So 34-36 (Fla 1931).

Descriptors: *Florida, *Riparian rights, *Rip land, *Relative rights, Beds, Legislation, Sh High water mark, Low water mark, Navi waters, Channels, Landfills, Tidal waters, aspects, Judicial decisions.

Plaintiff mortgagee sought to enforce a mort lien against riparian land, including subme land filled in by mortgagor's grantee. Defen was a judgment creditor of mortgagor's grantee contended that the filled in land was not subje the mortgage because it was filled in after the gagor's conveyance. The trial court subjected entire land to the mortgage lien and the Sup Court of Florida affirmed. The State Riparian which describes the rights of riparian owners, passed before execution of the mortgage, and in effect at execution. One of the rights grante the Act is the right to fill in submerged land. statutory rights were vested in the mortgagor thus were included in the mortgage lien. Righ the filled-in land were acquired subject to the and the fact that the grantee filled in the land sequently did not give the grantee statutory r against the mortgage lien. The source of tit submerged land is the statutory right vested i riparian owner and is obtained by the proce filling in. (Duss-Florida)
W71-04835

WATERS AND WATER SUPPLY--POLLUTI -PENALTY.
New Jersey Session Law Service, Chapter (1970), amending, NJ Revised Stat secs 58: 58:10-2, 58:10-4.

Descriptors: *New Jersey, *Water pollu *Remedies, *Legislation, Administrative agen Pollution abatement, Pollutants, Water pollu control, State governments, Non-structural alte tives, Legal aspects, Cities.

This amended statute provides that whoever lutes state waters shall be fined $1000 for the day and $3000 for each day thereafter. Each continuance is a separate offense. The local b of health in the jurisdiction where the offense curs is empowered to sue for payment of pena imposed by this section. The Department of He is authorized to settle with the offender. The recovered are to be paid either into the State T sury or into a municipal treasury, depending u the identity of the plaintiff in the action. In a tion, the statute provides that a summary injunc may be issued to restrain pollution. Either the partment of Health or a local health board seek the injunction. (Hart-Florida)
W71-04838

AN ACT TO CREATE AN ENVIRONMENT BOARD AND DISTRICT ENVIRONMENT COMMISSIONS.
Laws of Vermont, No 250, Public Acts, 1969 journed Session, p 237-250 (1970). 14 p.

Descriptors: *Vermont, *Legislation, *Adminis tive agencies, *Environment, Land managem Land development, Land classification, Land Land resources, Water resources, Nat resources, Scenery, Aesthetics, State governme Legal aspects, Administration, Permits, Admi trative decisions.

This legislation creates a state environmental bo and nine district environmental commissions. board and district commissions are to consider plications for permits to develop and subdiv land. Before granting permits, the commissi must consider whether subdivisions: (1) will re in undue air or water pollution; (2) have suffici water available; (3) will unreasonably burden ex ing water supplies; (4) will cause unreasonable erosion or reduce the capacity of the land to h water; (5) will cause highway congestion (6) unreasonably burden local educational facilit (7) will unreasonably burden local governme sources; or (8) will have an unduly adverse ef upon the scenic and natural beauty of the are

which proposed. A development must also conform to a development plan and a land use plan promulgated by the board. The purpose of the development plan is to achieve a coordinated, efficient, and economic development of the state. The land use plan is based upon the development plan and consists of a map and statements of present and prospective land uses. These plans must be approved by the governor. (Hart-Florida)
W71-04839

CALIFORNIA DEPT OF FISH AND GAME V S S BOURNEMOUTH (SHIP'S LIABILITY FOR DAMAGES RESULTING FROM OIL SPILL).
318 F Supp 839-842 (CD Cal 1970).

Descriptors: *California, *Oil wastes, *Ships, *Water pollution sources, Water pollution, Admiralty, Harbors, Navigable waters, Damages, Winds, Wind tides, Tides, Chemical analysis, Legal aspects, Judicial decisions, Oil industry.

Plaintiff state of California sought damages from defendant vessel for damages resulting from an oil spill in a harbor. Defendant denied that it was the source of the spill and contended that, even if it were the source of the pollution, there was no evidence of any intentional or negligent acts or omissions of the defendant's crew which might have caused the spill. The federal district court rendered judgment for the plaintiff. Evidence of the location of the spill in relation to the location of the ship and chemical analysis of oil from the spill supported a finding that defendant was the source of the oil spill. Secondly, the facts of the case presented an appropriate situation for application of res ipsa loquitur. Oil spills of this type would not ordinarily occur without negligence, and the evidence eliminated any other cause which might have been responsible for the spill. (Duss-Florida)
W71-04840

ENVIRONMENTAL SERVICE (CREATION OF STATE AGENCY FOR WASTE TREATMENT CONTROL).
Maryland Code Ann art 33B, secs 1 thru 32 (Supp 1970).

Descriptors: *Maryland, *Legislation, *Waste disposal, *Administrative agencies, Sewage disposal, Waste water disposal, Waste treatment, Solid wastes, Waste water (Pollution), Environmental sanitation, Sewage treatment, Waste water treatment, Water districts, Water purification, Public health, Water pollution treatment, Water quality control, Cities, Governments, State governments, Government finance, Government supports, Planning, Legal aspects.

To provide for more effective purification and disposal of liquid and solid wastes, the Maryland Environmental Service is created and provisions made for personnel and expenses. The Environmental Service shall be responsible for planning, research, development, and construction of waste water purification and solid waste disposal projects in cooperation with the affected municipalities. The Service may: (1) contract, (2) sue and be sued, (3) acquire property, (4) exercise eminent domain powers, and (5) borrow money and issue bonds to carry out its functions. The Service's prime responsibility is to create waste water purification and waste disposal regions and districts and, after public hearing, to adopt five-year plans for the projects needed in each region. Upon the failure of a person or a municipality to carry out an order of the Secretary of Health or the Secretary of Natural Resources, the Service may carry out those orders and charge the non-complying party for its expense in so doing. The Service is authorized to issue revenue bonds and fix rates and fees to provide a fund retirement fund. The Public Service Commission will arbitrate any rate disputes and judicial review shall be available, including the right of appeal to the Maryland Court of Appeals. (Liptak-Florida)
W71-04841

WETLANDS (REGULATION OF DREDGE AND FILL OPERATIONS ON STATE AND PRIVATE WETLANDS).
Md Code Ann, Art 66c, Secs 718 thru 731 (Supp 1970).

Descriptors: *Maryland, *Wetlands, *Dredging, *Landfills, Conversation, State governments, Tidal waters, Excavation, Land forming, Land development, Water conservation, Permits, Natural resources, Riparian rights, Riparian land, Water resources, Coasts, Environmental effects, Regulation, Administrative agencies, Administrative decisions, Legal aspects, Adjudication procedure, Legislation.

Whereas dredging, dumping, and filling are despoiling Maryland's wetlands and diminishing their value as wildlife habitats and recreation centers, it shall be public policy to protect and preserve the state's wetlands. Riparian owners shall be guaranteed the right to natural accretion and to make improvements, consistent with this policy, to preserve access to the water. All dredging and filling on the state's wetlands is unlawful unless licensed by the Board of Public Works. When considering a license application, the Board shall take into account the ecological, economic, developmental, recreational, and aesthetic factors of each project. Anyone violating the Act may be fined and shall pay the State for the restoration of the wetlands affected. The Secretary of Natural Resources shall make an inventory and a map of all private wetlands within the state and adopt rules and regulations governing dredging and filling of private wetlands. Affected landowners are entitled to a hearing and to a review of the inventory or the rules and regulations. Persons wishing to conduct activities not authorized by the rules and regulations may apply for a permit under defined application, notice, and hearing procedures. The Secretary shall consider the impact of the proposed work under the stated public policy. Parties are entitled to a jury trial de novo, not subject to the state administrative procedure act. Violators may be fined or imprisoned. Riparian rights are unaffected except as specifically provided. (Liptak-Florida)
W71-04842

PUBLIC WATER SUPPLY AND SEWER SYSTEM (FINANCIAL SUPPORT FOR MUNICIPAL SEWAGE TREATMENT WORKS).
Tennessee Code Ann secs 53-2017 thru 53-2028 (Supp 1970).

Descriptors: *Tennessee, *Legislation, *Sewage treatment, *Government supports, Treatment facilities, Public utilities, Sewage, Pumping plants, Sewage disposal, Municipal wastes, Industrial wastes, Domestic wastes, Sewers, Water Quality Act, Water pollution treatment, Governments, Local governments, State governments, Government finance, Water law, Taxes, Financing, Cost repayment, Water works, Water rates, Cities.

After defining sewage treatment works, construction, department, eligible project, municipality, and federal pollution abatement assistance, this chapter of the Tennessee Code authorizes the State of Tennessee to grant funds to assist municipalities in the construction of sewage treatment works. The public health department is designated to administer the grants and may contract with municipalities subject to specified financial provisions. A sewage treatment works construction fund is created in the state treasury and may be maintained by appropriations and bond sales. Municipalities receiving aid shall establish and collect a sewer users fee according to the listed schedule of residential and commercial-industrial users service charges. Cities may make sewer use mandatory, shall have enforcement powers, and may bring actions to collect delinquent charges. Municipalities may levy and collect additional fees or tolls for maintenance and operation or debt payments. Users fees shall be remitted to the state funding board for retirement of bond issues and any excess shall be returned to the municipalities. Deficiencies shall be paid out of increased user rates or ad valorem taxes, and the state may withhold funds from any muncipality failing to remit fees. (Liptak-Florida)
W71-04843

AALSBURG V CASHION (RELATIVE RIGHTS TO ACCRETED LAND ON NAVIGABLE LAKE SHORE).
180 NW2d 792-798 (Mich 1970).

Descriptors: *Michigan, *Accretion (Legal aspects), *Boundary disputes, *Real property, Relative rights, Lakes, Lake shores, Land tenure, Navigable waters, Riparian land, Bank erosion, Boundaries (Property), Riparian rights, Judicial decisions, Legal aspects.

Plaintiff riparian owners sought determination of riparian boundaries involving accreted land as against defendant adjoining riparian owners. The common grantor, after conveying all lots in question without riparian rights, executed a riparian deed creating riparian rights in all conveyed lots. Such deed also provided that a strip of shoreline along the navigable inland lake was subject to the use of all lot owners. Plaintiff asserted that defendant acquiesced, used, and consented to extension of their side lot lines in setting common boundaries over accreted lands. The Supreme Court of Michigan held that: (1) neither acquiescence nor hostile possession is made out by joint use of riparian property, nor by mutual reliance on terms of common riparian deed; and (2) a county survey will be given greater weight than a witness' testimony in determining the intent of the grantor of a common riparian deed. That part of the decision of the lower court finding neither acquiescence nor hostile possession was affirmed, and the case remanded for determination of the remaining issues. (Earl-Florida)
W71-04844

HOGUE V STRICKER LAND AND TIMBER CO (ALTERATION OF STATE BOUNDARY BY CHANGE IN CHANNEL OF MISSISSIPPI RIVER).
69 F2d 167-169 (5th Cir 1934).

Descriptors: *Louisiana, *Mississippi, *Mississippi River, *Boundary disputes, Boundaries (Property), Land tenure, Real property, Riparian land, Islands, Accretions (Legal aspects), Avulsion, Bank erosion, Erosion, Channels, State jurisdiction, Channel erosion, Channel flow, Rivers, Navigable rivers, Thalweg, Adjudication procedure, Legal aspects, Judicial decisions.

Plaintiff riparian landowner brought action against defendant land company to quiet title to accreted land. The question on appeal was the identity of the state in which the land was situated. The disputed land had accreted to an island in the Mississippi River. The river channel was originally east of the island, and hence the island was originally in Louisiana rather than Mississippi. That channel dried up and a new channel formed west of the island. Plaintiff claimed the land which had accreted between the two channels as accretions to his uplands on the Mississippi side. The Fifth Circuit Court of Appeals determined that when a stream's course between states changes by erosion and accretion, the boundary moves with the channel, but where the course changes by avulsion, suddenly leaving the old channel, the boundary is unaltered. Where, as in the instant case, the drying up of a channel results from the diversion of water into a new channel, rather than from accretion, the change must be likened to avulsion. In such a case state boundaries are unchanged. The court held that the disputed land was in Louisiana and that the Mississippi court was without jurisdiction. (Hart-Florida)
W71-04845

PRESERVATION OF FISHERY RESOURCES (AUTHORIZATION OF FEDERAL-STATE AGREEMENTS AND COST SHARING).
16 USCA secs 757 A (a), 757 A (c), 757 D (a) (Supp 1970) amending 16 USCA secs 757 A, 757 D (1964).

Descriptors: *Federal government, *State governments, *Anadromous fish, *Fish conservation, Legislation, Fisheries, Fish management, Fish populations, Environmental effects, Federal project policy, Cost allocation, Cost sharing, Project planning, Project purposes, Administrative agencies, Administrative decisions, Administration, Water resources development, Non-structural alternatives, Legal aspects, Conservation, Coordination, Contracts, Benefits, Fish.

The Secretary of the Interior is authorized by this legislation to enter into cooperative agreements with states or other non-federal interests to conserve, develop and enhance anadromous fishery resources which are being depleted by water resources developments. Any such agreement must prescribe: (1) actions to be taken by the parties; (2) expected benefits; (3) estimated costs; (4) the share of the costs to be borne by the respective parties; (5) duration; (6) means of disposing of property acquired during the agreement; and (7) other conditions the Secretary desires. The federal share of costs shall not be more than 50%, and the non-federal share may be in form of realty or personalty. When two states enter into the agreement with the Secretary, the federal share is increased to 60%. Appropriations through fiscal 1974 are established. (Hart-Florida)
W71-04846

ANDERSON V CITY OF LUDLOW (CITY'S LIABILITY FOR STORM-SEWER OVERFLOW FOLLOWING STREET IMPROVEMENTS).
250 Ky 204, 62 SW2d 785-788 (Ky 1933).

Descriptors: *Kentucky, *Storm drains, *Paving, *Flood damage, Cities, Drainage systems, Sewers, Floodwater, Soil surfaces, Overflow, Surface runoff, Damages, Surface drainage, Flow rates, Real property, Land tenure, Local governments, Legal aspects, Judicial decisions, Flow, Road construction, Excess water (Soils), Rainfall-runoff relationships.

Plaintiff residential lot owner sought to recover damages from defendant city for flooding resulting from storm sewer overflow. Plaintiff's property was flooded after defendant city paved and constructed catchbasins for nearby streets. The sewer line in question was constructed prior to the incorporation of plaintiff's property into defendant's municipal boundaries. Plaintiff contended that defendant's improvements created the overflow by diverting additional water into the formerly adequate sewer system. Defendant denied that its actions diverted surface water into the sewer lines at issue. The Court of Appeals of Kentucky held that a municipal corporation is not liable for flooding damages where street improvements merely accelerate but do not increase the volume of water flowing into a sewer line in existence prior to incorporation of territory into a city. The court denied plaintiff relief, ruling that defendant's street improvements had only accelerated the flow of water which previously was partially absorbed by trees and soil. (Earl-Florida)
W71-04847

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION OF LOWER SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W71-04849

6G. Ecologic Impact of Water Development

GEOLOGY FOR ENVIRONMENTAL PLANNING IN MONROE COUNTY, MICHIGAN,
Wayne State Univ., Detroit, Mich. Dept. of Geology.
For primary bibliographic entry see Field 04C.
W71-04370

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-04420

TECHNOLOGICAL INJURY,
Blackburn Coll. of Technology and Design (England).
J. Rose.
New York, Gordon and Breach, 1969. 224 p.

Descriptors: *Technology, *Pollution, *Environment, Air pollution, Water pollution, Pesticides, Computers, Transportation, Social aspects, Government, Radioactive wastes.
Identifiers: *Technological change, Noise, Level, Drugs.

This book is a collection of fifteen papers concerned with the effect of technology on environment, life and society. It attempts to present an account of the potential and actual dangers of technological advances by outlining the main areas of conflict and danger. It is of interest to the water researcher not only due to its explicit consideration of water pollution but also because of the insights it provides into water resources problems through the treatment of related environmental areas. The first section is concerned with pollution of the environment and considers the problems of air and water pollution, radioactivity, pesticides, drugs and pollution of outer space. The second section considers the effects on society and life of drugs, genetics, computers, transportation, noise, and leisure and concludes with a general discussion of the effect of technological change. (See also W71-04466) (Murphy-Rutgers)
W71-04465

MAN AND AQUATIC COMMUNITIES.

Spring 1970 seminar. Oregon State University, Corvallis, Water Resources Research Institute SEMN WR 012.70, 1970. 106 p, 11 fig, 2 tab, 71 ref. OWRR Project A-999-ORE (6).

Descriptors: *Ecology, *Aquatic environment, *Eutrophication, *Lakes, *Oregon, Industries, Marine animals, Fresh water, Radiation, Aquiculture, Fish, Ponds, Ecosystems, Monitoring, Management, Adhesives, Dye releases, Oysters, Bioassay, Salinity, Bacteria, Algae, Insects, Copepods, Detritus, Rhodophyta, Chlorophyta, Cyanophyta, Protozoa, Mollusks, Fungi, Ferns, Gymnosperms, Radioisotopes, Mussles, Snails.
Identifiers: *Rocky shores, *Cultural impact, *Lake evolution, Chironomids, Ostracods, Desmids.

Applied and more fundamental studies relating to metabolism and physiological requirements of algae and other aquatics, and to development of assay procedures for detecting increased enrichment and its effects are discussed. Rocky shores are described with plans for educational field trips. The Weyerhaeuser Company, supporting operations and products other than lumber, has research teams studying aquatic problems. Oyster investigations, experimental stream studies, liquid waste monitoring, and waste treatment facility performance are described. A historical review
algae is presented. Documentation of algae
human economy (exploitation of marine colloi
algal toxins), for utilization in human objectiv
(closed-system ecology--waste disposal), or
their contribution to animal production importa
in various human activities. Radioactive isotop
can provide information of movement of a sin
element from one organism to another or one tiss
to another and help unsort complexities of aqua
foodwebs. Radionuclide cycling makes possible
creased precision of measurement. Four lakes we
used to assess productivity and evolution due
cultural impact. Aquiculture industrial develo
ment at coastal steam-electric stations is underwa
Effect on marine biota of fluctuations in ocean
currents, temperature, and salinity, are studie
Public and private fish habitats are describe
(Jones-Wisconsin)
W71-04629

EFFECT OF COOLING TOWER EFFLUENT ON ATMOSPHERIC CONDITIONS I NORTHEASTERN ILLINOIS, PRELIMINAR REPORT,
Illinois State Water Survey, Urbana.
F. A. Huff, R. C. Beebe, D. M. A. Jones, G. M. Morgan, Jr., and R. G. Semonin.
Available from State of Illinois, Dept. of Registr tion and Education. Illinois State Water Surve Circular 100, 1971. 37 p, 1 fig, 2 tab, 57 ref.

Descriptors: *Cooling water, *Cooling tower *Water cooling, *Nuclear powerplants, *Wat pollution sources, *Air environment, *Meteor water, Thermal pollution, Fog, Cloud physics, A pollution, Air-water interfaces, Microenvironmen Micro-climatology, Weather modification, Rai fall, Snowfall, Computer models, Industrial water.
Identifiers: *Cooling tower effluents.

Controversy presently exists over the use of Lak Michigan and other natural water bodies for th discharge of waste heat from large electric powe plants. This problem has become especially acut in the case of a 2200-megawatt nuclear power plan of the Commonwealth Edison Company now nea ing completion at Zion, located on Lake Michiga in the northeastern part of Illinois. This plant wa designed for once-through-cooling utilizing lak discharge of the waste heat, but this method o cooling has met opposition. An alternative metho of solving the thermal pollution problem is throug the use of large cooling towers. However, this alter native then raises concern about the environmenta consequences of the effluent discharge into the at mosphere from the towers. Numerical modelin provided quantitative estimates of how high plume cloud ejected from the 250-foot Zion tower would rise. It was found that the top of the mois plume could vary between 1800 and 5500 feet Other results indicated that the enhancement o warm season rainfall by Zion tower plumes woul probably be negligible but an average annual in crease of 1 to 2 inches of snowfall could be ex pected within a distance of 2 miles inland from the power plant. Analyses indicated that the typical onshore lake breeze in spring and early summer would not normally trap the tower plume cloud near the ground to enhance inland fogging. The lake breeze interaction with the tower effluent is not expected to increase significantly convective cloudiness and rainfall in the Zion area. (Poertner)
W71-04682

THE ECONOMICS OF CLEAN WATER: INORGANIC CHEMICALS INDUSTRY PROFILE.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-04686

ECOLOGICAL MODELING RESEARCH IN THE GREAT LAKES,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries; and Michigan Univ., Ann Arbor. Dept. of Civil Engineering.

For primary bibliographic entry see Field 06A.
W71-04780

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.
For primary bibliographic entry see Field 06E.
W71-04788

WETLANDS (REGULATION OF DREDGE AND FILL OPERATIONS ON STATE AND PRIVATE WETLANDS).
For primary bibliographic entry see Field 06E.
W71-04842

07. RESOURCES DATA

7A. Network Design

MEAN DISCHARGE AS AN INDEX TO MEAN MAXIMUM DISCHARGE,
IE Dept., Ankara (Turkey).
or primary bibliographic entry see Field 02E.
V71-04394

7B. Data Acquisition

REAL MEASUREMENTS OF WATER QUIVALENT OF SNOW DEPOSITS BY IEANS OF NATURAL RADIOACTIVITY IN HE GROUND,
stitutt for Atomenergi, Kjeller (Norway); and orwegian Water Resources and Electricity Board, slo.
or primary bibliographic entry see Field 02C.
71-04374

ADIOACTIVE TRACING IN FROZEN IVERS,
eskoslovenska Akademie Ved, Prague. Inst. of ydrodynamics; Ceskoslovenska Akademie Ved, ague. Ustav Jaderneho Vyskumn; and ydrometeorologicky Ustav, Ostrava (C-choslovakia).
r primary bibliographic entry see Field 02C.
71-04382

PPLICATION OF THE THEORY OF GRAPHS INVESTIGATION OF COMMUNITIES OF QUATIC ORGANISMS, (IN RUSSIAN),
ademiya Nauk SSSR, Leningrad. Institut olyutsionnoi Fiziologii i Biokhimii.
V. Menshutkin.
glish summary. Zhurnal Obschchei Biologii, Vol , No 1, p 42-49, 1969. 5 fig, 10 ref.

scriptors: *Data collections, *Measurement, quatic populations, Analysis, Biomass, Primary oductivity, Energy, Predation.
ntifiers: *Graph theory, Trophic net, Linear ationships.

e theory of graphs promises a reduction in the of highly complex system of differential equa-ns requiring electronic computations. The struc-e of heterotrophic communities of aquatic or-isms are featured in terms of graphs and related ple equations comprising the trophic net and energy balance of populations. The method vides a possibility of estimating the ratio of the mass and primary production. Examples of mmunities made up of three and four popula-s illustrate conditions when suppression of dators is either harmful or beneficial. The phic approach has definite advantages because s simplicity, but its application is limited to sta-ary entities and linear trophic net relationships. lde-Wisconsin)
1-04522

RADIOACTIVITY IN CALIFORNIA WATERS JULY-DECEMBER 1968.
California State Dept. of Public Health, Berkeley. Bureau of Radiological Health.
For primary bibliographic entry see Field 05B.
W71-04530

ESTIMATING SUSPENDED SEDIMENT CONCENTRATIONS IN STREAMS BY TURBIDITY MEASUREMENTS,
Agricultural Research Service, Danville, Vt.; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
Samuel H. Kunkle, and George H. Comer.
Journal of Soil and Water Conservation, Vol 26, No 1, p 18-20, January-February 1971. 3 p, 3 fig, 10 ref.

Descriptors: *Suspended load, *Turbidity, Stream erosion, Scour, Sediment transport, Vermont, Sampling, Estimating, Erosion, Discharge (Water), Topography, Soil properties, Snowmelt.
Identifiers: *Sleepers River Experimental Watershed (Vt).

Turbidity and suspended sediment analyses were made on stream samples collected in the Sleepers River watershed of northeastern Vermont. Results showed that turbidimeter readings could be used to estimate suspended sediment concentrations in the 16- to 6,366-milligrams-per-liter range. The prediction equation was similar for the three watersheds studied, where soils, topography, and other factors were essentially the same. Samples were collected during two years of storm and snowmelt runoff on catchments draining from 16.2 to 43.5 square kilometers. Discharges reanged from 140 to 18,000 liters per second. The sediment particles were mostly of stream bank origin and were primarily silt or very fine sand. (Knapp-USGS)
W71-04560

DEEP-SEA IN SITU CALCIUM CARBONATE SATUROMETRY,
California Univ., Los Angeles. Dept. of Geology; and California Univ., Los Angeles. Geophysics and Planetary Physics.
S. Ben-Yaakov, and I. R. Kaplan.
Journal of Geophysical Research, Vol 76, No 3, p 722-731, January 20, 1971. 10 p, 4 fig, 4 tab, 21 ref. USAEC Contract AT (04-3)-34 PA 178.

Descriptors: *Calcium carbonate, *Aqueous solutions, *Sea water, *Water chemistry, *On-site tests, Sampling, Chemical precipitation, Saturation, Equilibrium, Instrumentation, Pacific Ocean, Chemical potential, Oxidation-reduction potential, Hydrogen ion concentration.
Identifiers: *Saturometers.

An in situ oceanographic system was used to measure the degree of saturation of calcium carbonate in sea water. Results of two profiles measured in the eastern Pacific Ocean off southern California are described and compared with data obtained by conventional chemical techniques. From this preliminary study it appears that the waters investigated become undersaturated with calcite at a depth of approximately 400 meters and remain so to a depth of about 1600 meters, where they tend toward saturation. Below 2500 meters they appear to become undersaturated again and probably remain so to the depth of the ocean floor. (Knapp-USGS)
W71-04568

A HYDROGEOPHYSICAL SURVEY USING REMOTE-SENSING METHODS FROM KAWAIHAE TO KAILUA-KONA, HAWAII,
Hawaii Univ., Honolulu. Dept. of Geology; and Michigan Univ., Ann Arbor.
William M. Adams, Frank L. Peterson, Surendra P. Mathur, Larry K. Lepley, and Clifton Warren.
Groundwater, Vol 9, No 1, p 42-50, January-February 1971. 9 p, 10 fig, 18 ref. OWRR Project B-015-HI (2).

Descriptors: *Remote sensing, *Geophysics, *Hydrogeology, *Hawaii, Infrared radiation, Electrical studies, Magnetic studies, Resistivity, Surveys, Groundwater movement, Discharge (Water).
Identifiers: Hawaii County (Hawaii).

Application of remote sensing techniques to the water resources of the Kona Coast of the island of Hawaii in Hawaii include aerial infrared scanning and low-level aeromagnetic surveys as major reconnaissance methods. For detailed study, modified audiomagnetotelluric and D. C. resistivity profiling methods were used. The improved knowledge of subsurface structure confirmed the expectation that no large flows, such as suitable for commercial exploration, occur in that coastal sector. (Knapp-USGS)
W71-04582

FLOW MEASUREMENTS IN THE DANUBE,
Vienna Univ. (Austria). Institut fuer Radiumforschung und Kernphysik; and Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna.
For primary bibliographic entry see Field 02E.
W71-04591

NUCLEAR TECHNIQUES IN STUDIES OF DISPERSION AND SOME OTHER PROPERTIES OF THE DANUBE,
Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia); and Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02E.
W71-04592

HYDRAULIC PROPERTIES RELATED TO STREAM REAERATION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-04593

TRITIUM STUDY OF THE MIXING OF WATERS IN LAKES AND ESTUARIES, WITH PARTICULAR REFERENCE TO THE LAKE OF GENEVA AND THE GIRONDE (FRENCH),
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research.
For primary bibliographic entry see Field 02H.
W71-04594

PORTABLE RADIOISOTOPE GAUGES FOR SUSPENDED SEDIMENTS,
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02J.
W71-04595

TURBIDIMETRY: MEASUREMENT OF X- OR GAMMA-ABSORPTION OR MEASUREMENT OF NATURAL RADIOACTIVITY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W71-04596

THE MASS OF LABELLED INJECTION SEDIMENTS FOR USE IN A RADIOACTIVE TRACER EXPERIMENT IN DYNAMIC SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W71-04597

TRACER DISPERSION IN GROUNDWATER EXPERIMENTS,
Institute of Nuclear Physics, Krakow (Poland).
For primary bibliographic entry see Field 02F.
W71-04598

USE OF GAMMA EMISSION FROM AMERICUM-241 TO MEASURE THE WATER CONTENT OF NONSATURATED SOIL SAMPLES (FRENCH),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
For primary bibliographic entry see Field 02G.
W71-04599

WATER-FLOW CALCULATIONS BY MEANS OF GAMMA-ABSORPTION AND TENSIOMETER FIELD MEASUREMENTS IN THE UNSATURATED SOIL PROFILE,
Niedersaechsisches Landesamt fuer Bodenforschung, Hanover (West Germany); and Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 02G.
W71-04600

PENETRATION RADIOACTIVE LOGGING FOR THE STUDY OF NON-SATURATED AND SATURATED AREAS (RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 04B.
W71-04601

APPLICATION OF THE SINGLE-WELL TECHNIQUE THROUGH THE LABELLING OF THE WHOLE PIEZOMETRIC COLUMN (SPANISH),
Ministry of Public Works, Madrid (Spain). Dept. of Nuclear Applications.
For primary bibliographic entry see Field 02F.
W71-04602

RADIOMETRIC METHOD FOR INVESTIGATING THE PERMEABILITY OF RESERVOIR BEDS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 04A.
W71-04603

NEUTRON INVESTIGATION OF THE RATE OF WATER SEEPAGE FROM IRRIGATION CHANNELS AND RESERVOIRS IN LOESSIAL LOAMS (RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 04A.
W71-04604

THE USE IN HYDROLOGY OF ISOTOPES PRODUCED BY PEACEFUL UNDERGROUND NUCLEAR EXPLOSIONS (RUSSIAN),
Hydrometeorological Service of the USSR, Moscow. Inst. of Applied Geophysics.
For primary bibliographic entry see Field 08H.
W71-04605

THE ENERGY BALANCE CLIMATOLOGY OF A CITY-MAN SYSTEM,
California Univ., Los Angeles. Dept. of Geography.
For primary bibliographic entry see Field 02A.
W71-04753

SOME TIME AND SPACE RESOLUTION REQUIREMENTS FOR SPACE OCEANOGRAPHY,
Bureau of Commercial Fisheries, Galveston, Tex.
For primary bibliographic entry see Field 05A.
W71-04801

PULP MILLS TAKE TO THE AIR TO MONITOR OCEAN OUTFALLS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 05A.
W71-04825

7C. Evaluation, Processing and Publication

MAP SHOWING AREAS SERVICED BY MUNICIPAL AND PRIVATE WATER-DISTRIBUTION AGENCIES, SAN FRANCISCO BAY REGION, 1970,
Geological Survey, Washington, D.C.
J. T. Limerinos, and Karen Van Dine.
Geological Survey Basic Data Contribution 4 (Map), 1970. 1 sheet, 2 map.

Descriptors: *Water distribution (Applied), *Water supply, *Distribution systems, *California, Conveyance structures, Pipelines, Water districts, Potable water, Sanitary engineering, Water delivery, Water management (Applied), Water works.
Identifiers: *San Francisco Bay region, *Water distribution agencies.

Eighty-four areas serviced by municipal and private water-distribution agencies, in 9 counties of the San Francisco Bay Region in 1970, are shown on this map. The counties included are Alameda, Napa, San Francisco, Santa Clara, Solano, Contra Costa, Marin, San Mateo, and Sonoma. The names of the agencies are also included. In addition to that map, an index map showing the 9 Bay area counties and the names of topographic map sheets is on the container cover. (Woodard-USGS)
W71-04366

MAP SHOWING AREAS SERVICED BY MUNICIPAL AND PRIVATE SEWERAGE AGENCIES, SAN FRANCISCO BAY REGION, 1970,
Geological Survey, Washington, D.C.
J. T. Limerinos, and Karen Van Dine.
Geological Survey Basic Data Contribution 5 (Map), 1970. 1 sheet, 2 map.

Descriptors: *Sewerage, *Sewage districts, *Maps, *Sewage disposal, *California, Pipelines, Conveyance structures, Municipal wastes, Domestic wastes, Networks, Regions, Water districts, Sanitary engineering, Water management (Applied).
Identifiers: *San Francisco Bay Region, Sewerage agencies.

One-hundred-sixteen areas serviced by municipal and private sewerage agencies, in 9 counties of the San Francisco Bay region in 1970, are shown on this map. The counties included are Alameda, Contra Costa, Marin, San Francisco, Napa, Solano, San Mateo, Santa Clara, and Sonoma. Related information shows sewerage agency boundaries, sewerage subarea boundaries, sewerage outfalls, sewerage-treatment plants, and sewerage-discharge lines. In addition to that map, an index map showing the 9 Bay area counties and the names of topographic map sheets is on the container cover. (Woodard-USGS)
W71-04367

COMPUTER SIMULATION OF URBAN STORM WATER RUNOFF,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 04C.
W71-04574

DIGITAL COMPUTER SIMULATION OF WASTE TREATMENT PLANTS USING THE WATCRAP-PACER SYSTEM,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
P. L. Silveston.
Water Pollution Control, Volume 69, No 6, p 686-693, 1970. 8 p, 5 fig, 4 tab, 6 ref, 1 append.

Descriptors: Digital computers, *Simulation analysis, *Waste water treatment, *Computer programs.
Identifiers: Computer subroutines, Ontario.

The initial phase of an investigation of the adec
cy of process models available in sanitary
chemical engineering and a demonstration
suitable sets of process models are capable
reproducing the performance of operating wa
treatment plants were discussed. The WATCR
PACER, a digital computer program which si
lated the behavior of plants treating dome
and/or industrial waste waters was developed
use by engineers with minimal knowledge of c
puters and programming. First the general
gram, PACER, was described as having an exe
tive program and a library of subroutines wh
model unit processes and operations such as
ing, chemical reactions, and distillation. A rec
system determined by the executive program
PACER was shown. For simulation of streams
waste treatment plant network, 'information' c
tent for each stream was used by and stored in
PACER executive as a stream variables list or v
tor. A short vector consisting of the standard t
used to characterize wastes and a long vector c
sisting of BOD, total and volatile suspended sol
as well as temperature and alkalinity was used
the WATCRAP program. The WATCR
PACER system was applied to a conventional
tivated-sludge treatment plant at Kitchener an
trickling filter plant at Oshawa in Ontario. (Kr
Cornell)
W71-04772

08. ENGINEERING WORKS

8A. Structures

**MAP SHOWING AREAS SERVICED BY M
NICIPAL AND PRIVATE WATER-DISTRIB
TION AGENCIES, SAN FRANCISCO BAY R
GION, 1970,**
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-04366

**PROCEEDINGS WORKSHOP ON STREA
CHANNELIZATION AND WETLA
DRAINAGE.**
North Carolina Water Resources Research In
Raleigh.
For primary bibliographic entry see Field 04A.
W71-04673

**AMENDED 1964 MASTER PLAN OF WATE
WORKS IMPROVEMENTS FOR BOARD
WATERWORKS COMMISSIONERS, MADISO
WISCONSIN, 1969 REVISION.**
Black and Veatch, Kansas City, Mo.

Board of Waterworks Commissioner, Madiso
Wisconsin, April 28, 1969. 60 p, 6 fig, 13 tab.

Descriptors: *Municipal water, *Water suppl
*Water works, *Planning, *Administration, Pr
ject planning, Water demand, Deep-well pumpin
Construction costs, Water conveyance, Comput
programs, Water wells, Cities, Future plannin
Wisconsin.
Identifiers: *Waterworks improvements, Madison

A study was conducted to: (1) review and amend
1964 Black and Veatch Master Plan of Waterwor
Improvements as supplemented by a 1967 Unive
sity Study; (2) correlate new potential develo
ment areas located beyond the present water se
vice area with the Madison utility facilities; (
evaluate water use and development trends durin
the past five years; and (4) modify previous
recommended improvements resulting fro
changed conditions. The recommendations mad
to the City of Madison are: (1) continue plannin
to serve a population of 240,000 by 1980; (2) giv
consideration to computerizing the tabulation
water sales to provide water-use records; (3) pr
vide for a 1980 maximum daily demand rate of 7
mgd; (4) install 167,000 feet of water mains durin

1969-1974 and 198,300 feet during 1975-1980; (5) replace the two Dayton Street Reservoirs; (6) modify existing unit well station booster pumping facilities to change discharge gradients and capacities; (7) construct three new unit well supplies before 1974 and one between 1975 and 1980; and (8) construct five new ground storage reservoirs with a total capacity of 9 mg. In addition, miscellaneous improvements to booster stations, unit wells and water mains are recommended. The cost estimate for the initial (1969-1974) construction is $5,202,800. Additional requirements during the 1975-1980 period are estimated at $4,626,000. (Poertner)
W71-04678

THE FINITE DAM II,
Western Australia Univ., Nedlands.
P. B. M. Roes.
Journal of Applied Probability, Vol 7, No 3, p 599-616, December 1970. 18 p, 3 fig, 11 ref.

Descriptors: *Water allocation (Policy), *Weirs, *Water balance, Inflow, Overflow, Laplaces equation, Markov processes, Time.
Identifiers: *Finite dam.

A weir of capacity K was considered in which the water inflow was a process with stationary independent increments. When the weir was empty, there was a continuous release of water at unit rate; if K was infinite the weir became full in which case the excess water overflowed instantaneously. A weir for which K was infinite was referred to as an infinite dam. Its transient behavior was well known if the input possessed a second moment. A complete description of the process which used the Laplace transform (L.T.) of the Laplace Stieltjes transform (L.S.T.) was presented. The dam processes considered were Markov processes. L.S.T.'s of first entrance and taboo first entrance times and first skip times and taboo first skip times were determined. From the (taboo) first entrance and skip times, first entrance times for the finite dam were derived, which led to the renewal functions of the renewal processes imbedded in the finite dam content process v* (t) and hence to the transient behavior of the finite dam. The advantage of this approach was that it seemed entirely probabilistic and avoided involved analytic arguments. (Kriss-Cornell)
W71-04771

8B. Hydraulics

MEASUREMENT OF VARIABLE FLOW PATTERNS BY A METHOD INVOLVING DILUTION OF RADIOACTIVE TRACERS (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
J. Guizerix, R. Margrita, J. Molinari, B. Gaillard, and P. Calmels.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/27, p 463-477, 1970. 15 p, 10 fig, 2 ref.

Descriptors: *Discharge measurement, *Tracers, *Tracking techniques, *Mixing, Streamflow, Hydraulic models, Model studies, Flowmeters, Path of pollutants, Unsteady flow, Non-uniform flow, Diffusion, Dispersion.
Identifiers: *Mixing (Tracers).

Measuring variable water flow patterns is an important problem for the calibration of limnimetric stations and certain hydroelectric installations, and also for determining the pollution of industrial effluents. Although the flow pattern is linear with respect to the tracer, the water and tracer, taken together, form a non-linear system. The conditions for linearizing the problem were studied in an experimental channel. As the tracer is injected at a constant rate, continuous measurements of its concentration are made in a section downstream. An analysis of the problem and the method of calculating flow are presented. Very good agreement is shown to obtain between the flow thus calculated and the flow measured by a turbine at the entrance to the channel. (Knapp-USGS)
W71-04383

THE CONCEPT OF 'GOOD MIXING' IN THE USE OF TRACERS: DISCHARGE VELOCITY AND VELOCITY OF THE CENTER OF GRAVITY OF A TRACER CLOUD IN FLOW STUDIES (FRENCH),
Toulouse Univ. (France). Institut de Mecanique des Fluides; and Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
M. Alquier, J. Gruat, G. Courtois, and G. Sauzay.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/26, p 441-461, 1970. 21 p, 4 fig, 2 ref.

Descriptors: *Tracers, *Tracking techniques, *Mixing, Diffusion, Streamflow, Measurement, Statistical methods, Probability, Dispersion, Dye releases, Radioisotopes, Tagging, Discharge (Water), Discharge measurement.
Identifiers: *Mixing (Tracers), *Streamflow tracing.

In measuring flows by means of tracers it is common to use integration methods which use the concept 'condition of good mixing'. This relation is general, regardless of the method used, and may be deduced from general definitions of perfect tracers and of the extent to which the flow is represented by the tracer. It appears to be a necessary and sufficient condition for measuring flow by tracers, independent of the initial injection conditions. A relation can therefore be established between the flow and one or more characteristic parameters of the movement of the tracer. For example, in the methods using the velocity of the center of gravity of a cloud of tracer, there is a relation between this velocity and the mean velocity of the fluid. The value of the ratio between these two velocities is a function of the profile of the velocities of the flow studied. This calculation makes use of the theory of probability and principles of fluid mechanics. A number of methods use the idea of the mean time of transit between two given sections. Formulas used in these calculations are listed. (Knapp-USGS)
W71-04384

APPLICATION OF PROBABILITY TO SPILLWAY DESIGN FLOOD ESTIMATION,
State Rivers and Water Supply Commission, Melbourne (Australia).
G. N. Alexander.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 536-543, 1969. 8 p, 3 fig, 19 ref.

Descriptors: *Probability, *Design flood, *Probable maximum precipitation, *Flood forecasting, *Peak discharge, Discharge (Water), Rainfall-runoff relationships, Reservoir design, Flood control, Statistical methods, Risks, Depth-area-duration analysis.
Identifiers: Spillway design flood, Australia.

There are two schools of thought concerning the estimation of floods which should be adopted for the design of spillways for large dams. The first is the method of Probable Maximum Precipitation (PMP). This method uses the maximization and transposition of storms and avoids any reference to risk. The second uses procedures of mathematical statistics to determine the required capacity for a selected level of probability. There are serious limitations at present in both approaches: in the first, the limitation is inherent, for PMP cannot be quantitatively defined and hence estimates are primarily matters of judgment; in the second, the procedures have not been sufficiently developed to be acceptable to the engineering profession generally. The discussion of the problems includes: (a) the purely mathematical problem of estimating the probability of occurrence of an event in a given period such as the 'life' of a dam given the return period of the event; (b) the socio-economic problem of estimating the risk to be stipulated for spillway design floods, as influenced by the number and life of dams; (c) some mathematical probability procedures using distributions in time and space for estimating rare events; in particular the observed data can be 'extended', provided that the initial data are statistically homogeneous. (Knapp-USGS)
W71-04389

COMPUTATION OF DESIGN SPRING FLOOD HYDROGRAPH,
All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR).
G. A. Leskov.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 722-727, 1969. 6 p, 3 fig, 1 tab.

Descriptors: *Design flood, *Snowmelt, Hydrographs, Flood forecasting, Reservoir design, Flood control, Probability, Frequency analysis, Peak discharge.
Identifiers: USSR.

When designing hydraulic structures on rivers and reservoirs and determining spillway capacity and dimensions for controlling high floods, it is necessary to evaluate not only the design discharge of the river at the proposed dam site but also to have a hydrograph of the entire flood wave for a given design probability. The procedure developed in the 'Hydroproject', USSR, allows, under condition of availability of a long series of river runoff observations, calculation and plotting of a flood hydrograph corresponding to the given probability of instantaneous discharge and that of maximum runoff for periods of one day and longer. The proposed procedure may be applied to rivers on which the yearly flood peak can easily be determined. (Knapp-USGS)
W71-04405

STOCHASTIC MODEL FOR SAND DISPERSION,
Illinois Univ., Urbana. Water Resources Center; Illinois State Water Survey, Urbana; and Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
For primary bibliographic entry see Field 02J.
W71-04573

VERTICAL DENSITY CURRENTS--II,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02H.
W71-04606

MATHEMATICAL MODEL FOR WATER DISTRIBUTION SYSTEMS,
Arya Mehr Industrial Univ., Tehran (Iran).
Mehdi S. Zarghamee.
Journal of the Hydraulics Division, ASCE, Vol 97, No HY1, p 1-14, January 1971. 15 p, 8 fig, 1 tab, 5 ref, 2 append.

Descriptors: *Mathematical models, *Computer program, *Water distribution (Applied), Steady flow, Simulation analysis, Network design, Hydraulics.
Identifiers: *Hardy Cross method, *Newton iteration method, Nonlinear equations, Iran, Chizar reservoir, Niavaran reservoir.

A mathematical model was developed for predicting the steady-state flow pattern for a water distribution system consisting of conduits, pumps,

pressure reducing valves, and reservoirs. The model was a computerized numerical simulation of the network. Each component was assumed to be governed by a specific, characteristic flow formula which in most cases was nonlinear. The equilibrium of flow in the network was governed by a system of nonlinear equations which were solved by the Newton iteration method. A great deal of numerical effort was saved by combining several conduits that were formulated to form an equivalent conduit. The mathematical model developed was coded in a computer program and was verified against the Hardy Cross method which involved joint relaxation in contrast to the proposed method where the entire network was relaxed simultaneously. Comparison revealed that the rate of convergence of the proposed method was greater than that of the Hardy Cross method. The existing water distribution system which supplies water to the Chizar area, Tehran, Iran, consisting of the Chizar reservoir and the Niavaran reservoir, served as an example for analysis of the method described. (Kriss-Cornell)
W71-04775

8C. Hydraulic Machinery

OPTIMIZATION OF AN ELECTRODIALYSIS PLANT,
McDonnell Douglas Astronautics Co., Newport Beach, Calif. Water Technology Dept.
George Belfort, and John A. Daly.
Desalination, Vol 8, No 2, p 153-166, October 1970. 14 p, 7 fig, 3 tab, 8 ref.

Descriptors: *Optimization, *Simulation analysis, *Mathematical models, *Digital computer, *Electrodialysis, Costs, Operations, Streams, South Dakota, Desalination.
Identifiers: Webster (S Dak).

Using models of both the cost procedures and the physical plant design, an optimization routine was constructed for an electrodialysis plant. An introduction to previous optimization studies, including a frequently used linear model was presented first. A detailed description of the combined simulation model, used as the kernel of the optimization routine, was divided into two parts: a model of the electrical properties of the electrodialysis stacks and a model of the costs associated with a given plant design. The two models were combined and programmed for a digital computer. In order to discover the optimum configuration, the independent or decision variables used were: (1) the stack design to be used; (2) the number of parallel streams in the plant; (3) the number of stages or stacks per stream; and (4) the reduction of salt concentration that was to be accomplished in each stage. A flow chart for the program was given and the optimization process where two or more stack designs were compared for particular application was summarized. The algorithm was applied to plant requirements at Webster, South Dakota and compared actual cost and operating conditions with optimal and nonoptimal conditions. Other uses of the model were also considered. (Kriss-Cornell)
W71-04767

8D. Soil Mechanics

GROUNDWATER MEASUREMENTS AT THE SITE OF THE SYLVENSTEIN DAM IN THE BAVARIAN ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
For primary bibliographic entry see Field 02F.
W71-04385

DETERMINING SEEPAGE CHARACTERISTICS OF MILL-TAILINGS DAMS BY THE FINITE-ELEMENT METHOD,
Bureau of Mines, Spokane, Wash. Mining Research Lab.
C. Daniel Kealy, and Richard A. Busch.
Report of Investigations 7477, January 1971. 113 p, 2 tab, 34 fig, 52 ref, 4 append.

Descriptors: Mine wastes, Waste disposal, *Mine drainage, Mine water, Groundwater movement, Waste dumps, Hydraulic models, *Seepage, Environmental engineering, Environmental sanitation, Slope stability, Soil physical properties, Mathematical models, *Earth dams, Phreatic lines.
Identifiers: *Tailings dams.

Finite-element, mathematical models that solve LaPlace's or Richard's equation numerically were used to locate the phreatic surface within tailings pond embankments and to define the subsurface flow of water from the pond. Both must be known to design structurally and environmentally safe tailings dams. The permeability distribution within and beneath the embankment, and the geometry and elevation of an approximately impermeable layer at some depth beneath the embankment were used as inputs in analyzing over a dozen finite-element models of tailings dams varying from simple to complex. Results predicted with the finite-element model were confirmed with measurements in a laboratory model of a tailings pond and in the field. Of particular importance to the design of safe slopes, all data indicated that the phreatic surface within a tailings dam is concave upward, a configuration opposite that in most earth dams. The close correlation between predicted and experimental values confirmed the practicability of using the finite-element technique to design safe tailings dams.
W71-04425

8H. Rapid Excavation

THE USE IN HYDROLOGY OF ISOTOPES PRODUCED BY PEACEFUL UNDERGROUND NUCLEAR EXPLOSIONS (RUSSIAN),
Hydrometeorological Service of the USSR, Moscow. Inst. of Applied Geophysics.
Yu. A. Izrael', and F. Ya. Rovinskiy.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/59, p 815-820, 1970. 6 p, 1 fig, 1 tab.

Descriptors: *Nuclear engineering, *Nuclear explosions, *Hydrogeology, *Tracers, *Path of pollutants, Radioisotopes, Radioactive wastes, Tritium, Groundwater movement, Excavation, Underground.
Identifiers: *USSR, *Nuclear explosions (Underground).

Various isotopes produced during the construction of hydraulic engineering works by means of underground nuclear explosions are discussed with reference to their use as tracers for the investigation of the hydrological regime in the construction area. An assessment is given of the relative yields of the isotopes, their capacity to pass into aqueous solutions and their migration potential, taking into account their distribution over the various zones and carrier particles and the effects of fractionation. It is concluded that the best tracer for solving hydrological and hydrogeological problems is tritium. Study of the migration of other isotopes is important from the point of view of possible radioactive contamination of water. Experimental data are given on the migration of radioactive isotopes during construction of a model reservoir in the Soviet Union and on the role of these isotopes in the study of the hydrological regime of the reservoir. (Knapp-USGS)
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- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification of pollutants at the Battelle Memorial Institute.
- Coastal pollution at the Oceanic Research Institute.

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- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 10
MAY 15, 1971

W71-04851 -- W71-05334

se of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency, Water Quality Office. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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1B. Aqueous Solutions and Suspensions

SPECIFIC CONDUCTANCE AS A MEANS OF ESTIMATING IONIC STRENGTH,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
W71-04975

02. WATER CYCLE

2A. General

THE EFFECT OF SELECTED HYDROLOGIC VARIABLES ON STREAM SALINITY,
Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
H. B. Pionke, and A. D. Nicks.
International Association of Scientific Hydrology Bulletin, Vol 15, No 4, p 13-21, December 1970. 9 p, 5 fig, 4 tab, 7 ref.

Descriptors: *Water quality, *Rainfall-runoff relationships, *Streamflow, *Salinity, Precipitation (Atmospheric), Antecedent precipitation, Regression analysis, Rain gages, Oklahoma.
Identifiers: Stream salinity forecasting.

A relationship of hydrologic variables with stream salinity was determined statistically for two ephemeral streams located in western Oklahoma. The hydrologic variables employed in this study are measures of streamflow, precipitation, antecedent conditions, and agricultural land use. The best single estimate of stream salinity was achieved by use of those variables classed as direct measures of precipitation, with the greatest variability in stream salinity (51%) being predicted by the maximum amount of precipitation received at any rain gage one in the watershed during one month. Antecedent conditions did not correlate well with stream salinity, except for the variable describing the antecedent stream salinity. Similarly, the areal location of precipitation within the watershed and agricultural land use did not correlate significantly with stream salinity, except for a variable designating the distance between the stream gaging station and the rain gage zone receiving the most precipitation for the month. The best overall estimate of salinity was given by a multiple regression equation chosen on the basis of a factor analysis. This equation accounted for 65% of the variability in salinity and emphasized the contribution of variables classed as direct measures of precipitation. In comparing the two streams, the watershed having the most intensive rain gage network produced the best prediction equation. (Knapp-USGS)
W71-04897

WATER RESOURCES OF EUROPE,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
I. M. Chernogaeva.
International Association of Scientific Hydrology Bulletin, Vol 15, No 4, p 67-76, December 1970. 10 p, 5 fig, 1 tab, 31 ref.

Descriptors: *Water balance, *Runoff, *Hydrologic budget, Hydrology, Water resources, Hydrologic cycle, Climates, Climatology, Mapping, Reviews.
Identifiers: *Water balance (Europe), *Europe.

This paper outlines the results of the research of the water balance of Europe which is a part of the research work on the water balance of the USSR and the continents carried on by the USSR Institute of Geography. The research has been done on the basis of the complex differentiated water balance equations which make it possible to determine major water sources including a soil water component. In Europe the surface runoff varies greatly, from 10 mm in the arid steppes of the European part of the USSR up to 1500 mm and over in the Alpine and neve-glacial belts of mountain areas. An increase in the surface runoff is appreciable on elevations and in mountains, especially on the western slopes of longitudinally elongated mountain ridges as compared with the eastern ones. As a whole, relative values of the European water balance are near to the corresponding values for the whole Earth. (Knapp-USGS)
W71-04899

HYDROLOGIC AND PHOTOGEOLOGIC DETERMINATION OF RAINFALL, RUNOFF, AND GROUNDWATER RELATIONSHIPS IN A DOLOMITE AREA,
Missouri Water Resources Research Center, Rolla; and Missouri Water Resources Research Inst., Rolla.
Vernon A. C. Gevecker, and James C. Maxwell.
Available from NTIS as PB-197 734, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Jan 15, 1971. 14 p, 2 tab, 4 fig. OWRR Project A-013-MO (1).

Descriptors: *Runoff, *Recharge, *Groundwater, Water wells, Rainfall-runoff relationships, Missouri, *Photogrammetry, Dolomite.
Identifiers: *Ozark watershed.

The goal was to determine the procedures needed to evaluate availability and disposition of surface and subsurface waters in an 18 square mile Ozark watershed underlain by partially cavernous dolomite. Hydrologic objectives were compilation and analysis of rainfall and streamflow records to estimate losses of surface water and recharge to groundwater. Photogeologic objectives were to identify, map and measure soils, vegetation, land use, sinkholes, linears, and drainage patterns. Stream recording was interrupted by bed load which blocked recorder inlets, by highway crews who altered channels, and by flood loss of a recorder house. Flows at high stages were unobtainable because of their infrequency, unpredictability and short duration. Rainfall was measured by volunteers. Soil types were identified on airphotos and mapped. Land use and vegetation were also photo-mapped. Water wells, located by field interviewing and measured when possible, were mapped. Stream losses in the upper creek were not calculable but in the lower reaches were 18 cubic feet per second. Runoff of 5.1 to 5.4 inches per square mile was 12 to 14 percent of the annual rainfall of 37 to 41 inches. (Maxwell-Missouri)
W71-04937

A METHOD FOR RELATING INFILTRATION RATES TO STREAMFLOW RATES IN PERCHED STREAMS,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02F.
W71-04971

SYNTHESIZING HYDROGRAPHS FOR SMALL SEMIARID DRAINAGE BASINS,
Geological Survey, Cheyenne, Wyo.
G. S. Craig, Jr.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D238-D243, 1970. 6 p, 6 fig, 1 tab, 1 ref.

Descriptors: *Hydrograph analysis, *Peak discharge, *Ephemeral streams, Hydrographs, Frequency analysis, Wyoming, Rainfall-runoff relationships, Arid lands, Runoff forecasting, Streamflow forecasting.
Identifiers: Hydrograph synthesis.

Studies of hydrograph shape for 14 small (less than 11 sq mi) drainage basins led to the development of a possible standard dimensionless hydrograph for semiarid regions. The dimensionless hydrograph, described in detail, was developed with data from small, ephemeral streams in Wyoming. Hydrographs are synthesized from the dimensionless hydrograph by using peak discharge-volume relationships. Only the single-peak event is considered. Synthetic hydrographs produced from the Wyoming dimensionless hydrograph show close agreement with observed hydrographs from Wyoming, New Mexico, and Arizona. The procedure can be used to define a hydrograph for any selected design value of peak frequency. (Knapp-USGS)
W71-04972

THE EFFECT OF STREAM DISCHARGE ON STREAMBED LEAKAGE TO A GLACIAL OUTWASH AQUIFER,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 02F.
W71-04973

MASS, MOMENTUM, AND ENERGY BUDGET EQUATIONS FOR BOMAP COMPUTATIONS,
National Oceanic and Atmospheric Administration, Rockville, Md., The BOMAP Office.
Eugene M. Rasmusson.
National Oceanic and Atmospheric Administration Technical Memorandum ERL BOMAP-3, January 1971. 32 p, 1 fig, 4 ref, 4 append.

Descriptors: *Model studies, *Atmosphere, *Water vapor, *Hydrologic budget, *Mathematical models, Oceans, Mass, Momentum transfer, Energy, Pressure, Equations, Latent heat, Radiation, Hydrologic data, Data collections, Ships, Aircraft, Air masses, Meteorology, Climatology, Synoptic analysis.
Identifiers: BOMEX project.

Basic atmospheric budget equations were modified for use in computing the budgets of mass, momentum, and energy for the atmospheric part of the BOMEX volume, as related to the Barbados Oceanographic and Meteorological Experiment (BOMEX), May-July, 1969. Observations made during the Experiment were to estimate the total transfer of water vapor, sensible heat, and momentum from sea to air over a 500- by 500-km square. This was done by measuring the quantities entering into the continuity or conservation equation for each property, with sufficient time and space resolution to allow the integrals over the 500-km square, through approximately the lower 6 km of the atmosphere, and over a time period of 1 day. These integrated conservation equations are called the 'budget equations.' (Woodard-USGS)
W71-05052

AVERAGE ANNUAL PRECIPITATION AND RUNOFF IN NORTH COASTAL CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05096

WATER RESOURCES OF THE WILD RICE RIVER WATERSHED, NORTHWESTERN MINNESOTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
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WATER RESOURCES OF THE RED LAKE RIVER WATERSHED, NORTHWESTERN MINNESOTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05114

REGIONALITIES OF CLIMATIC VARIATIONS OF THE WORLD,
Tokyo Metropolitan Univ. (Japan). Faculty of Science.
For primary bibliographic entry see Field 02B.
W71-05199

2B. Precipitation

A COMPARISON OF ENERGY BALANCE METHODS FOR ESTIMATING ATMOSPHERIC THERMAL RADIATION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-04852

SPLASH AMOUNTS FROM WATERDROP IMPACT ON A SMOOTH SURFACE,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02J.
W71-04865

FACTORS AFFECTING VARIATIONS OF MEAN ANNUAL RAINFALL IN ISRAEL,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
M. H. Diskin.
International Association of Scientific Hydrology Bulletin, Vol 15, No 4, p 41-49, December 1970. 9 p, 1 fig, 5 tab, 4 ref.

Descriptors: *Rainfall disposition, *Distribution patterns, Regression analysis, Rain gages, Variability, Arid lands, Precipitation (Atmospheric), Synoptic analysis, Isohyets, Weather data, Data collections.
Identifiers: *Israel.

A stepwise multiple linear regression analysis was used to study factors that affect the mean annual rainfall in Israel. The factors investigated were latitude, elevation, and easterly distance from the sea. Separate equations, relating the 30-year mean rainfall to these factors were derived for the northern and southern parts of the country. The regression equations reduced most of the variance of the rainfall data for the 211 rain-gaging stations included in the study. The three factors found to affect the mean annual precipitation in the northern half of the country were the latitude of the rain-gaging station, its elevation, and its longitude or easterly distance from the shore line. In the southern half of the country only the latitude and longitude appear to affect significantly the magnitude of the mean annual precipitation. Mean annual rainfall increased with the latitude of the station and with its elevation and decreased with the longitude of the station or its easterly distance from the sea. The orographic effect on mean annual precipitation in the northern half of Israel is of the order of 30 mm increase in precipitation for each 100 meters increase in elevation. The effect of longitude or easterly distance from the sea is of the order of 290 mm per degree of longitude or about 3.1 mm/km for the northern part of the country and 140 mm per degree or 1.5 mm/km in the southern part. A change of latitude of one degree causes a change of precipitation of about 210 mm (1.9 mm/km) in the norther part of the country and about 120 mm (1.1 mm/km) in the south. If the change in latitude is not made along the meridian, but along a line parallel to the shoreline, the change in the mean annual precipitation in the northern part is about 100 mm (0.9 mm/km). (Knapp-USGS)
W71-04898

THE EXPERIMENTAL MODIFICATION OF LAKE-EFFECT WEATHER,
Cornell Aeronautical Lab., Inc. Buffalo, N.Y.
William J. Eadie.
Available from NTIS as COM-71-00009, $3.00 in paper copy, $0.95 in microfiche. Final report, CAL Report No VC-2898-P-1, Aug 1970. 88 p, 8 fig, 6 tab, 16 ref. ESSA Contract No E 22-6-69 (N).
Identifiers: *Weather modification, *Great Lakes, *Snow fall, Reduction, Cloud seeding, Snowstorms, Intensity, Silver iodide, Ice, Meteorological radar, Radar echo areas, Dry ice, Mathematical models, Lake Erie, *Lake effect snowstorms.

During November and December of 1968, field experiments were carried out on the southeastern shore of Lake Erie to determine the feasibility of modifying lake-effect weather. The primary objective of the experiments was to test the hypothesis that the snowfall from intense lake-effect storms could be redistributed over a larger area by overseeding with ice nuclei, thereby reducing the heavy natural snowfall near the lee shore. The experiments demonstrated that overseeding can be accomplished for short periods in lake-effect snow bands of moderate intensity.
W71-04951

PROJECT SKYWATER, PROCEEDINGS: SKYWATER CONFERENCE IV OPTIMIZATION OF OPERATIONAL WEATHER MODIFICATION.
Bureau of Reclamation, Denver, Colo. Office of Atmospheric Water Resources.
For primary bibliographic entry see Field 03B.
W71-04956

A RARE EVENT OF INTENSE RAINFALL,
Bell Telephone Labs., Inc., Holmdel, N.J. Crawford Hill Lab.
R. A. Semplak.
Monthly Weather Review, Vol 99, No 2, p 155-157, February 1971. 3 p, 5 fig, 5 ref.

Descriptors: *Rainfall, *New Jersey, *Rain gages, *Rainfall intensity, *Distribution patterns, Networks, Precipitation intensity, Depth-area-duration analysis, Runoff, Urbanization, Cities.
Identifiers: Holmdel (New Jersey).

Data are presented for the most intense storm observed during a 3-yr recording period (1967-1969) on the Crawford Hill rain gage network at Holmdel, N.J. Point rain rates in excess of 270 mm per hr (10.6 in per hr) were observed. A total of about 280 million gallons of water fell in a 15-min interval over an area of 32.3 sq km (12.5 sq mi). (Knapp-USGS)
W71-05060

1968 FLORIDA CUMULUS SEEDING EXPERIMENT: NUMERICAL MODEL RESULTS,
National Oceanic and Atmospheric Administration, Miami, Fla. Experimental Meteorology Lab.
For primary bibliographic entry see Field 03B.
W71-05061

A STUDY OF THE HYDROLOGY OF EASTERN NORTH AMERICA USING ATMOSPHERIC VAPOR FLUX DATA,
Environmental Science Services Administration, Princeton, N.J. Geophysical Fluid Dynamics Lab.
Eugene M. Rasmusson.
Monthly Weather Review, Vol 99, No 2, p 119-135, February 1971. 17 p, 19 fig, 14 tab, 30 ref.

Descriptors: *Synoptic analysis, *Water balance, Evapotranspiration, Rainfall, Runoff, Water storage, Droughts, Precipitation (Atmospheric), Climatology, Hydrology, Weather, Atmosphere, Climatic data, Meteorology.
Identifiers: Flux divergence, Atmosphere.

The atmospheric water vapor flux divergence and the water balance of Eastern North America were investigated, using data from the period May 1, 1958, to April 30, 1963. Mean monthly values of evapotranspiration and storage change were computed as residuals, using measured values of vapor flux divergence, precipitation, and streamflow. Computed values of evapotranspiration and storage change were compared with the climatological estimates of Thornthwaite Associates and Budyko. The Thornthwaite climatic water balance data appear to overestimate the difference between precipitation and evapotranspiration, during winter and underestimate it during summ
dyko's values of evapotranspiration generall
a slightly smaller seasonal variation and ap
lead the values obtained from the atmos
budget computations by around 0.5 to 1 m
divergence computations were made for the
Mexico and Caribbean Sea. Interannual var
in storage over the Eastern Region of North
ica were found to be comparable with the se
changes. The onset of the drought of the ea
mid-1960s is clearly reflected in the cor
storage values. Variations in mean m
precipitation during winter are positively
lated with the strength of the northward f
moisture across the Gulf Coast, but little or n
tionship between these quantities appears t
during summer. (Knapp-USGS)
W71-05062

**ANOMOLY PATTERNS OF CLIMATE
THE WESTERN UNITED STATES, 1700
DERIVED FROM PRINCIPAL COMPO
ANALYSIS OF TREE-RING DATA,**
Arizona Univ., Tucson. Lab. of Tre
Research.
V. C. LaMarche, and H. C. Fritts.
Monthly Weather Review, Vol 99, No 2,
142, February 1971. 5 p, 2 fig, 3 tab, 7 ref.
Grants E88-67-G and E231-68-G, NASA
NGR 03-002-101.

Descriptors: *Dendrochronology, *Pa
matology, *Droughts, Climatology, Ec
Forests, Paleohydrology, Trees, Plant g
Water shortage, Statistical methods, Freq
analysis.
Identifiers: *Western U.S.

Major anomaly patterns of annual tree-ring g
in 'drought-sensitive' trees of the Western U
States, 1931-1962, seem to reflect correspo
patterns in monthly precipitation amounts,
in turn may be related to circulation anom
The three most important anomaly pattern
dominated the 1931-1962 period were
prominent in the tree-growth data durin
preceeding period 1700-1930. These pattern
thus be expected to maintain their importanc
ing at least the immediate future. Time se
eigenvector amplitudes show how the relativ
portance of the anomaly patterns changes th
time. These can be studied for properties le
possible forecasting value and may provide i
tant insight into the past behavior of th
mospheric circulation over the Western U
States. (Knapp-USGS)
W71-05063

A DYNAMICAL MODEL OF FOG,
Advanced Technology Labs, Inc., Jericho, N.
Antonio Ferri, Paolo Baronti, and Sheldon Elz
Available from NTIS as AD-714 625, $3.
paper copy, $0.95 in microfiche. Rept no.
TR-159, Sep 70. 45 p, 12 fig, 6 ref. AF Co
F44620-70-C-0007.
Identifiers: *Fog, Mathematical models, D
Condensation, Evaporation, Heat transfer, V
vapor, Numerical analysis, Temperature pro
Supersaturation.

A model is presented to explain why fogs c
maintained for extended periods of time.
model considers the fog as a dynamical sy
whereby droplets depletion through fall is bal
by a continuous process of evaporation and
densation. The controlling parameters of
process are the heat transfer from the ground
the level of turbulence. The equations descr
the system are presented and solved. Numerica
amples are given and compared with experim
data.
W71-05151

**REGIONALITIES OF CLIMATIC VARIATI
OF THE WORLD,**
Tokyo Metropolitan Univ. (Japan). Facult
Science.

Toshinari Ambe.
Japanese Journal of Geology and Geography, Vol 18, No 1, p 63-77, 1967. 12 fig, 1 tab, 9 ref.

Descriptors: *Arid lands, *Climatic zones, *Geographical regions, *Water balance, *Climatic data, Maps, Statistical analysis, Temperature, Climatology, Precipitation (Atmospheric), Evaporation, Temperature, Deserts, Foreign countries, United States, Mexico, Distribution patterns, Classification, Variability.
Identifiers: *Climatic transitional regions, *Climatic classification, *Climatic types, *Potential evapotranspiration, Global studies, Continents, Hemispheres, Transitional region, South America, Asia, Africa, Australia.

It is argued that most climatic classification systems differ from the practice of defining climatic boundaries on the basis of long term yearly averages, and that unstable regions are therefore ignored. A 'transitional region' is an area where the climatic type alternates yearly in accordance with boundary variations. Since the climate of a transitional region is inherently unstable, water need planning for such a region must differ from that for humid or arid regions. Using data from the previous study on arid climate variability, the ranges of transitional regions of arid climates were determined for each continent (except parts of Asia where data are lacking). This was done by using an index of variability of arid climates depending upon the number of arid years and humid years between 1931-1960. Maps are presented for each continent. A global climatic map was then constructed with 3 climatic types--real arid regions, transitional regions and regions without an arid year. Excepting North Africa, real arid regions are not a large proportion of the area where arid years occur, and lie generally in the 25-35 deg. latitudinal zone. The transitional region occurs very widely, and in many cases should be considered as an independent region rather than as a mere boundary area. This is an important aspect of a geographical factor, and offers many problems concerning land use or agriculture. (Casey - Arizona)
W71-05199

C. Snow, Ice, and Frost

ENERGY EXCHANGE AND LATE SEASON SNOWMELT IN A SMALL OPENING IN COLORADO SUBALPINE FOREST,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
David R. Dewalle, and James R. Meiman.
Water Resources Research, Vol 7, No 1, p 184-188, February 1971. 5 p, 1 fig, 3 tab, 7 ref.

Descriptors: *Snowmelt, *Colorado, *Solar radiation, Melting, Radiation, Snowpacks, Energy budget, Runoff forecasting, Forests, Albedo, Data collections.
Identifiers: Radiation (Net).

Two-day melt of a late lying snow patch in a small opening in Colorado subalpine forest was largely due to net radiation and sensible heat exchange. Net radiation supplied 54% and 62% of melt energy on June 19 and 20, 1968, respectively, whereas sensible heat exchange accounted for 49% of melt energy. Three percent of melt energy was lost by evaporation each day. (Knapp-USGS)
W71-04863

PASSIVE MICROWAVE MEASUREMENTS OF SNOW, SOILS, AND OCEANOGRAPHIC PHENOMENA,
Aerojet-General Corp., El Monte, Calif. Space Div.
For primary bibliographic entry see Field 07B.
W71-04942

MIGRATION OF POLLUTANTS IN A GLACIAL OUTWASH ENVIRONMENT,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 05B.
W71-05046

SOME RESULTS FROM A TIME-DEPENDENT THERMODYNAMIC MODEL OF SEA ICE,
Washington Univ., Seattle. Dept. of Atmospheric Sciences and; Washington Univ., Seattle. Geophysics Program.
Gary A. Maykut, and Norbert Untersteiner.
Journal of Geophysical Research, Vol 76, No 6, p 1550-1576, February 20, 1971. 26 p, 12 fig, 8 tab, 55 ref. ONR Contract N00014-67-A-0103-0007.

Descriptors: *Sea ice, *Energy budget, *Mathematical models, *Numerical analysis, Solar radiation, Currents (Water), Snow cover, Heat transfer, Melting, Freezing, Water temperature, Ablation, Salinity, Albedo, Thermodynamics, Diffusion.
Identifiers: Sea ice model.

A one-dimensional thermodynamic model of sea ice includes the effects of snow cover, ice salinity, and internal heating due to solar radiation. Surface-energy balances determine rates of ablation and accretion; diffusion equations govern heat transport within the ice and snow. The incoming radiative and turbulent fluxes, oceanic heat, flux, ice salinity, snow accumulation, and surface albedo are specified as functions of time. The model was applied to the central Arctic. Values predicted by the model for the average ice thickness (288 cm) amount of surface ablation (40 cm), and the temperature field all agree closely with field observations. Other results from the model indicate that, under present conditions, the ocean supplies 1 to 2 kcal/sq cm year to the ice; an additional 4 kcal/sq cm year would cause the ice to vanish. Annual snow depths less than 70 cm would result in much thicker ice. About 2.0 to 2.5 kcal/sq cm year of the incoming short-wave radiation penetrates the ice and contributes to internal heating. Average ice albedos under 0.50 would cause the ice to vanish in a few years. (Knapp-USGS)
W71-05054

DESCRIPTION AND EVOLUTION OF SNOW AND ICE FEATURES AND SNOW SURFACE FORMS ON THE KASKAWULSH GLACIER,
Vermont Univ., Burlington. Dept. of Geology.
W. Philip Wagner.
In: Icefield Ranges Research Project Scientific Results, Volume 1: American Geographical Society (New York) and Arctic Institute of North America (Montreal), p 51-53, 1969. 3 p, 1 fig, 5 ref.

Descriptors: *Glaciers, *Regimen, *Diagenesis, *Snowmelt, *Ablation, Snowpacks, Seasonal, Geomorphology, Water balance, Ice, Snow, Movement, Climates, Weather, Stratigraphy.
Identifiers: Icefield Ranges (Canada), Snowfields.

Investigations of numerous snow pits on the Kaskawulsh Glacier suggested that the 1963 summer could be viewed in terms of a threefold, sequential development of surface and subsurface features related to snowmelt. Stage 1 was characterized by thin ice layers and rounded, medium-grained snow immediately underlying a non-descript snow surface. Stage 2 began on July 1 with a pronounced warm spell. Features characteristic of Stage 2 included surface depressions, ice and slush glands, 'slush columns', and 'slush walls'. Lateral expansion of surface depressions and related subsurface features occurred during Stage 2. By July 21, growth of surface depressions resulted in a snow surface with conspicuous mounds (distinctive for Stage 3), remnants of the inter-depression areas of Stage 2. Stages 1 and 3 began and ended when melt began in the spring and ended in the fall, respectively; the dates of these stages are unknown. (Knapp-USGS)
W71-05097

SNOW FACIES AND STRATIGRAPHY ON THE KASKAWULSH GLACIER,
Vermont Univ., Burlington. Dept. of Geology.
W. Philip Wagner.
In: Icefield Ranges Research Project Scientific Results, Volume 1: American Geographical Society (New York) and Arctic Institute of North America (Montreal), p 55-62, 1969. 8 p, 7 fig, 5 tab, 4 ref.

Descriptors: *Glaciers, *Regimen, *Diagenesis, *Snowmelt, *Ablation, Snowpacks, Seasonal, Geomorphology, Water balance, Ice, Snow, Movement, Climates, Weather, Stratigraphy.
Identifiers: Icefield Ranges (Canada), Snowfields.

Measurements of snow temperature, density, hardness, accumulation, and stratigraphy were made during the 1963 melt season in the accumulation zone of the north and central arms of the Kaskawulsh Glacier, Yukon Territory, Canada. The ablation facies extended from the glacier terminus at 810 m to the firn line at 1990 m. Temperature, hardness, and stratigraphic relationships located the saturation line, which separates wetted and percolation facies, between 2330 m and 2420 m. Significant melt occurred everywhere on the glacier; hence the dry snow facies was precluded. In contrast, the variation of density with altitude, which was found to be gradational across the saturation line, as defined by temperature, hardness, and stratigraphic data, suggests that only one facies (the wetted facies) occurred everywhere in the accumulation zone. However, because density is not thought to be a useful parameter for separating wetted and percolation facies on the Kaskawulsh Glacier, the density data are rejected as a primary parameter. It is concluded on the basis of temperature, hardness, and stratigraphy that both wetted and percolation facies were present. Thus the Kaskawulsh Glacier was subpolar in 1963. (Knapp-USGS)
W71-05098

O-18/O-16 RATIOS IN SNOW AND ICE OF THE HUBBARD AND KASKAWULSH GLACIERS,
Calgary Univ. (Alberta). Dept. of Geology; and Calgary Univ. (Alberta). Dept. of Physics.
D. S. Macpherson, and H. R. Krouse.
In: Icefield Ranges Research Project Scientific Results, Volume 1: American Geographical Society (New York) and Arctic Institute of North America (Montreal), p 63-73, 1969. 11 p, 12 fig, 10 tab, 25 ref.

Descriptors: *Stable isotopes, *Oxygen, *Glaciers, *Regimen, *Water balance, Water sources, Climates, Winds, Precipitation (Atmospheric), Tracers, Distribution patterns, Weather patterns.
Identifiers: *Oxygen isotopes, Icefield Ranges (Canada).

One hundred samples collected from the Hubbard and Kaskawulsh Glaciers in the St. Elias Mountains during the summer of 1963 were analyzed for O-18 and O-16. The delta O-18 values ranged from -18 to -29, with an average of about -23. Pits that were studied before extensive melting showed definite trends in delta O-18 with the more negative values corresponding to winter precipitation. Pits studied later in the season had the seasonal trend masked by the action of downward percolating meltwaters. The average of all pits and boreholes studied above the firn line gave no indication of an altitude variation of delta O-18 larger than the sampling error. A longitudinal profile below the firn line showed much scatter in the value, but the average trend was a decrease in going down-glacier from the firn line to the terminus. A transverse profile below the firn line which sampled three main ice streams gave remarkably consistent values near the margins, whereas the stream centers had decidedly more positive or negative values. These results are considered in terms of accepted modes of glacier flow. Precipitation studies exhibited much scatter and did not show the expected altitude variation. Much of the precipitation in the area is derived from the Pacific Ocean rather than from inland sources. (Knapp-USGS)
W71-05099

HIGH SNOWFIELDS OF THE ST. ELIAS MOUNTAINS,
Cold Regions Research and Engineering Lab., Hanover, N. H.

Edward Grew, and Malcolm Mellor.
In: Icefield Ranges Research Project Scientific Results, Volume 1: American Geographical Society (New York) and Arctic Institute of North America (Montreal), p 75-87, 1969. 13 p, 10 fig, 1 tab, 18 ref.

Descriptors: *Snowpacks, *Solar radiation, *Profiles, Water balance, Stratigraphy, Albedo, Glaciers, Density stratification, Snow cover, Snow surveys, Snowmelt, Infiltration.
Identifiers: *St. Elias Mountains (Canada).

Observations made during the 1964 summer provide a description of snow and radiation characteristics for the St. Elias Mountains and give insight into effects of altitude when anomalous wind and slope effects are excluded. Divide Camp, Seward Camp, and Lucania Camp were occupied successively within a minimum period of time to compare conditions at different altitudes. Data are presented on snow profiles, snow accumulation measurements, the development of the annual snow layer, snow conditions at depth, the mechanical properties of the snow, snow densification, solar radiation, and the variation of snow properties with surface altitude. It is concluded that as long as local anomalies are avoided, the effects of surface altitude on snow properties and surface processes seem to be simple. In Mountain regions it is usually a combination of local conditions which produces the effects. (Knapp-USGS)
W71-05100

MORPHOLOGY OF THE SLIMS RIVER,
New York State Univ. College, Fredonia.
For primary bibliographic entry see Field 02J.
W71-05101

ICEFIELD RANGES RESEARCH PROJECT SCIENTIFIC RESULTS, VOLUME 1,
American Geographical Society, New York, and Arctic Inst. of North America, Montreal (Quebec).
Vivian C. Bushnell, and Richard H. Ragle.
American Geographical Society (New York) and Arctic Institute of North America (Montreal), 1969. 224 p.

Descriptors: *Glaciers, Mountains, Climatology, Meteorology, Hydrology, Hydrogeology, Topography, Geomorphology, Limnology, Stratigraphy, Ecology, Projects, Grants, Arctic, Cold regions, Subarctic.
Identifiers: *Snowfields, St. Elias Mountains, Icefield Ranges (Canada), Geography.

The Icefield Ranges Research Project, under the institutional sponsorship of the Arctic Institute of North America and the American Geographical Society, seeks understanding of the natural environment of the St. Elias Mountains of Alaska and Yukon Territory. The project is multidisciplinary in its areas of research, and it is also interdisciplinary in its approach to its objectives. The Icefield Ranges Research Project has now completed eight field seasons, and the contents of this volume are representative of field work performed during the first four, from 1961 to 1965. (Knapp-USGS)
W71-05103

THE CHENA RIVER, THE STUDY OF A SUBARCTIC STREAM,
Federal Water Quality Administration, College, Alaska. Alaska Water Lab.
For primary bibliographic entry see Field 05B.
W71-05143

GREAT LAKES SNOWSTORMS. PART 1. CLOUD PHYSICS ASPECTS,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
James E. Jiusto, and Edmond W. Holroyd, III.
Available from NTIS as COM-71-00012, $3.00 in paper copy, $0.95 in microfiche. Jun 70. 153 p, 42 fig, 13 tab, 71 ref. ESSA Grant No E22-49-70 (G).
Identifiers: *Cloud seeding, *Great Lakes, *Snowstorms, Reduction, Cloud physics, Silver iodide, Aerosols, Freezing, Condensation nuclei, Atmospheric physics, Temperature, Meteorological radar, Dry ice, Snow fall, Radar cross sections, Networks, Mathematical models, Computer programs, Lake Erie, Lake Ontario, *Lake effect snowstorms.

Studies of the synoptic, mesoscale, and microphysical characteristics of snowstorms occurring to the lee of Lakes Erie and Ontario were done, with emphasis on defining precipitation mechanisms, land structure, aerosol characteristics and snowfall patterns. Cloud seeding was performed with silver iodide and with dry ice. The practical implications of each modification concept cannot be definitely assessed, but seeding with additional freezing nuclei to increase ground or lake precipitation can be accomplished, and seeding from the ground offers experimental and operational advantages. Snow crystal concentration at ground level is an effective measure of modification efficacy. It is recommended that the ground observer network be increased by a factor of 3, and that the duration and area of seeding be increased by at least a factor of 2 to 3.
W71-05153

APPLICATION OF METHOD FOR PREDICTING THERMAL ERROR IN MEASUREMENT OF GROUND TEMPERATURE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
Warren M. Rohsenow.
Available from NTIS as AD-818 015, $3.00 in paper copy, $0.95 in microfiche. Cold Regions Research and Engineering Lab Technical Report 186, May 1967. 6 p, 8 fig, 1 tab, 1 ref. Army Corp of Eng Contract DA-19-016-ENG-3204.
Identifiers: *Terrain, Surface temperatures, Instrumentation, Probes, Predictions, Errors, Atmospheric temperature, Heat transfer, Measurement, Snow, Ice, Permafrost, Soils.

The use is illustrated of generalized charts in estimating the thermal error in measurement of ground temperature in the case of a probe inserted in a pit wall. The word 'ground' includes snow and ice as well as soil materials. Two major sources of error, other than instrument error, are inherent in this type of measurement. If the air temperature differs from the ground temperature, heat will be exchanged between the air and side walls of the excavation as soon as the pit is opened. The ground temperature must be read before appreciable heat transfer occurs. A second error is introduced upon insertion of the temperature sensing element if the element temperature differs from the ground temperature.
W71-05257

LOW-TEMPERATURE PHASES OF INTERFACIAL WATER IN CLAY-WATERS SYSTEMS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Duwayne M. Anderson, and Allen R. Tice.
Available from NTIS as AD-715 714, $3.00 in paper copy, $0.95 in microfiche. Research Report 290, Oct 1970. 15 p, 3 fig, 2 tab, 19 ref.
Identifiers: *Clay minerals, Water, *Arctic regions, Construction, Thermal analysis, Interfaces, Frost heave, Freezing, Phase studies, Ice, *Clay water systems, Frozen soils, *Interfacial water.

Low temperature differential thermal analyses of selected clay-water systems were made to locate important phase change temperatures and to define fruitful temperature-pressure fields for precise calorimetric investigation. In addition to an exotherm corresponding to initial freezing, one, two or three exotherms were observed between -35 C and-60 C. The low temperature exotherms do not depend critically upon water content, but clearly they are related to clay mineral and exchangeable cation type. The evolution of heat in this temperature range probably corresponds to a phase change in the interfacial water.
W71-05258

THE TEMPERATURE STRUCTURE OF A LATITUDE, DIMICTIC LAKE DURING FI ING, ICE COVER, AND THAWING,
Cold Regions Research and Engineering Hanover, N.H.
For primary bibliographic entry see Field 02H
W71-05259

2D. Evaporation and Transpira

A COMPARISON OF ENERGY BAL METHODS FOR ESTIMATING ATMOSPH THERMAL RADIATION,
Agricultural Research Service, Phoenix, Water Conservation Lab.
Keith R. Cooley, and Sherwood B. Idso.
Water Resources Research, Vol 7, No 1, p February 1971. 7 p, 3 fig, 2 tab, 18 ref.

Descriptors: *Solar radiation, *Energy b *Evapotranspiration, Heat budget, Cloud Evaporation, Hydrologic cycle, Transpir Measurement, Data collections, Data process
Identifiers: *Radiation balance.

A radiation balance method and a modified tion balance method were used to determine and daily values of atmospheric thermal rad on three clear and three cloudy days February and March 1970 at Phoenix, Ar The radiation balance was used over surfa bare soil, Bermuda gross, and open wate modified radiation balance was used over the water surface only. The modified radiation ba differed from the pure radiation balance met that net radiation was calculated as the resid the energy equation rather than measured values of atmospheric thermal radiation thu tained were compared to values obtained measurements of incoming, all-wave rad minus incoming solar radiation. The best al tive to the semi-direct measurement of atmosp thermal radiation was the radiation balance the bare soil surface. Results from this m were of sufficient accuracy, even on an hour sis, for most research studies, and were even on a daily basis. Radiation balances over gras water surfaces were somewhat less satisfactor still better than the modified radiation ba method. (Knapp-USGS)
W71-04852

SOME OBSERVATIONS ON THE EFFEC WIND INDUCED THERMAL MIXING,
Saskatchewan Research Council, Saskatoon.
G. Lakshman.
Water Resources Research, Vol 7, No 1, p 194, February 1971. 6 p, 8 fig, 2 ref.

Descriptors: *Evaporation, *Lakes, *M *Winds, *Thermal stratification, Energy bu Water temperature, Radiation, Solar radia Mass transfer, Convection, Advection, Ponds.
Identifiers: Saskatchewan.

Wind induced thermal mixing in a pond or s influences the diurnal variation in the water su temperature. This, in turn, greatly affects the of evaporation from the water surface. The imum diurnal rise in the water temperature pends on the total duration of sunshine, the imum rise in air temperature above the initial temperature, and the wind speed. Sheltering a may increase the rate of evaporation under ce conditions. (Knapp-USGS)
W71-04864

EVAPORATION LOSSES IN SPRINKLER RIGATION,
Florida Univ., Gainesville. Dept. of Agricul Engineering; and Florida Univ., Gainsville. W Resources Research Center.
J. M. Myers, C. D. Baird, and R. E. Choate.

vailable from NTIS as PB-197 735, $3.00 in aper copy, $0.95 in microfiche. Florida Water esources Research Center, Publication No 12, ecember 31, 1970. 41 p, 1 tab, 17 fig, 34 ref. WRR Project A-003-FLA (2).

escriptors: *Irrigation, *Evaporation, Wind elocity, Water temperature, Dew point, Air temerature, *Rates of application, Interception, Irgation efficiency, *Sprinkler irrigation, Florida.
entifiers: Evaporation loss.

ater conservation, distribution of chemicals rough irrigation water and the increasing popuity of low application rate irrigation systems are important factors pointing up the need for more ecision in irrigation management which in turn is pendent upon accurate estimates of expected aporation losses. Data has been obtained to pret the independent effect of water application e, air (wind) velocity, water temperature and y bulb and dew point temperature of the ambient on evaporation losses by water droplets and ter droplets in combination with plant interpted water. By far the most influential factor on aporation losses is the rate of application. Results dicate evaporation losses are about 60% for low plication rates (0.15 iph) with climatic condins typical of Florida and when plant foliage is esent to intercept most of the applied water.
71-04938

STUDY OF THE HYDROLOGY OF EASTERN ORTH AMERICA USING ATMOSPHERIC POR FLUX DATA,
vironmental Science Services Administration, nceton, N.J. Geophysical Fluid Dynamics Lab.
r primary bibliographic entry see Field 02B.
71-05062

STS OF SOLAR RADIATION MODELS IN REE FOREST CANOPIES,
Diego State Coll., Calif. Dept. of Biology.
C. Miller.
ology, Vol 50, No 5, p 878-885, 1969. 2 fig, 4 , 12 ref.

scriptors: *Solar radiation, *Mathematical dels, Forecasting, Photosynthesis, Primary ductivity, Evaporation.
ntifiers: *Forest canopies, Leaf area.

eral models expressing the decrease of solar iation in vegetation canopies have been posed. The models are similar in (1) including a hod of projecting the shadow of one or more es into a horizontal plane and (2) including a hod of relating the projected shadow to the rease of solar radiation. The models differ in the ations used and in the assumptions made. The dels use the binomial, the Poisson, or some dification of the binomial to relate the projected low to the radiation at different levels. When models were tested against the percentage of it area at different levels in the canopy, the best ng model was one proposed in this paper in ch the shadow of the leaf is projected as a low of a cone and the binomial is used to exs the decrease of radiation. Negative exponenmodels usually overestimated the percentage of Including the shadow cast by twigs and nches in the prediction improved the agreement veen the observed and the expected percentage un. Primary production models in which the ative exponential is used to calculate solar ation may overestimate the actual production.
adhyaya-Vanderbilt)
1-05131

APORATION REDUCTION WITH FLOAT-GRANULAR MATERIALS,
cultural Research Service, Phoenix, Ariz. er Conservation Lab.
primary bibliographic entry see Field 03B.
-05138

A DYNAMICAL MODEL OF FOG,
Advanced Technology Labs, Inc., Jericho, N.Y.
For primary bibliographic entry see Field 02B.
W71-05151

2E. Streamflow and Runoff

ANALYSIS OF THE USE OF DISTORTED HYDRAULIC MODELS FOR DISPERSION STUDIES,
California Univ., Berkeley. Dept. of Civil Engineering; and Illinois Univ., Urbana. Dept. of Civil Engineering.
Hugo B. Fischer, and E. R. Holley.
Water Resources Research, Vol 7, No 1, p 46-51, February 1971. 6 p, 3 fig, 8 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Dispersion, *Mixing, *Waste dilution, Steady flow, Unsteady flow, Path of pollutants, Lakes, Rivers, Estuaries, Model studies.
Identifiers: Distorted hydraulic models.

The model ratios applicable to dispersion studies in distorted hydraulic models are investigated for both steady and oscillatory flow, and the effects of both vertical and transverse distributions of velocity on the dispersion process are considered. It is shown that simple transposition of concentration profiles from model to prototype is not valid and that models may magnify or reduce longitudinal dispersion depending on the geometry of the system. For that reason, physical models are unlikely to be useful for studies of pollutant dispersion. (Knapp-USGS)
W71-04853

NUMERICAL SIMULATION OF FLOOD WAVE MODIFICATION DUE TO BANK STORAGE EFFECTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W71-04854

A COMPARATIVE STUDY OF CRITICAL DROUGHT SIMULATION,
California Univ., Los Angeles. Dept. of Engineering Systems.
For primary bibliographic entry see Field 04A.
W71-04861

LAW OF STREAM RELIEF IN HORTON'S STREAM MORPHOLOGICAL SYSTEM,
Hawaii Univ., Honolulu. Water Resources Research Center.
Yu-Si Fok.
Water Resources Research, Vol 7, No 1, p 201-203, February 1971. 3 p, 1 tab, 5 ref.

Descriptors: *Topography, *Geomorphology, *Drainage patterns (Geologic), Statistical methods, Elevation, Erosion, Mapping, Shape, Slopes, Valleys, Mathematical studies.
Identifiers: Stream order.

Within a river basin, the streams can be classified by the Horton-Strahler stream order system. The average stream lengths and slopes are semilogarithmic functions of the stream order. In this study, paralleling Horton's development, the law of stream relief is proposed and the average stream relief is found also to be a semilog function of the stream order. The riverbed profile can be described by a semilog equation expressing stream relief as a function of stream length. The F value in the stream relief equation may be considered as an indicator of the riverbed profile properties. (Knapp-USGS)
W71-04866

FLOOD ROUTING THROUGH STORM DRAINS: PART I. SOLUTION OF PROBLEMS OF UNSTEADY FREE SURFACE FLOW IN STORM DRAINS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-04890

FLOOD ROUTING THROUGH STORM DRAINS: PART II. PHYSICAL FACILITIES AND EXPERIMENTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-04891

FLOOD ROUTING THROUGH STORM DRAINS: PART III. EVALUATION OF GEOMETRIC AND HYDRAULIC PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-04892

PROGRAM OF THE WATER RESOURCES DIVISION, TEXAS DISTRICT, FOR THE 1971 FISCAL YEAR AND SUMMARY OF DISTRICT ACTIVITIES DURING FISCAL YEAR 1970.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-04906

WILD RIVERS -- METHODS FOR EVALUATION,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 06B.
W71-04930

STORM RUNOFF RESPONSE FROM ROAD-BUILDING AND LOGGING ON SMALL WATERSHEDS IN THE OREGON COAST RANGE,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04C.
W71-04968

A METHOD FOR RELATING INFILTRATION RATES TO STREAMFLOW RATES IN PERCHED STREAMS,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02F.
W71-04971

SYNTHESIZING HYDROGRAPHS FOR SMALL SEMIARID DRAINAGE BASINS,
Geological Survey, Cheyenne, Wyo.
For primary bibliographic entry see Field 02A.
W71-04972

THE EFFECT OF STREAM DISCHARGE ON STREAMBED LEAKAGE TO A GLACIAL OUTWASH AQUIFER,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 02F.
W71-04973

EVALUATION OF THE STREAMFLOW DATA PROGRAM FOR ARKANSAS,
Geological Survey, Little Rock, Ark.
For primary bibliographic entry see Field 07C.
W71-04974

WATER RESOURCES OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK, TENNESSEE AND NORTH CAROLINA,
Geological Survey, Washington, D.C.
W. M. McMaster, and E. F. Hubbard.

For sale by US Geological Survey, Washington, DC 20402 - Price $1.50, per set. Geological Survey Hydrologic Investigations Atlas HA-420, 2 sheets, 1970. Text, 13 fig, 2 map, 5 tab, 15 ref.

Descriptors: *Water resources, *Surveys, *Hydrologic data, *Tennessee, *North Carolina, Water resources development, National parks, Hydrogeology, Streamflow, Topography, Water supply, Water yield, Water wells, Water quality.
Identifiers: *Great Smoky Mountains National Park.

The Great Smoky Mountains National Park is located on the Tennessee-North Carolina border in the southern part of the Appalachian Range. In order to plan effectively for the development of new facilities, and the management of the park's resources, the Park Service needs information on how much water is available at different places in the park. This 2-sheet hydrological atlas is intended to satisfy that need. Sheet 1 covers the surface-water resources in the park and sheet 2 the ground-water resources. Emphasis was placed on evaluating the occurrence, availability, and quality of groundwater. An important part of the study is the flow of streams, particularly low flows. Low flows are a limiting factor when developing a stream for water supply. Low-flow data are also essential in stream-pollution studies and for the protection of aquatic life and resident environment. Many recreational uses of the streams also depend on adequate low flows. The park is located in one of the wettest regions of the United States. Precipitation in the park as a whole averages 64 inches annually. Average discharge ranges from less than 2 to more than 4 cfsm. The low flows of the streams are more variable than the average flows. Seven-day, 2-year minimum flows range from less than 0.1 to more than 0.8 cfsm. Availability of groundwater and surface water is shown by maps. Other hydrologic data are summarized in hydrographs, duration curves, graphs, charts, and tables. (Knapp-USGS)
W71-04979

FLOOD OF MARCH 1968 ON THE SUDBURY, ASSABET, AND CONCORD RIVERS, MASSACHUSETTS,
Geological Survey, Washington, D.C.
R. G. Petersen, G. K. Wood, and R. A. Gadoury.
For sale by US Geological Survey, Washington, DC 20402 - Price $1.25 per set. Geological Survey Hydrologic Investigations Atlas HA-371, 2 sheets, 1970. Text, 3 fig, 3 photo, 2 tab, 6 ref.

Descriptors: *Floods, *Massachusetts, *Antecedent precipitation, *Snowmelt, Rainfall-runoff relationships, Surface-groundwater relationships, Hydrologic data, Overflow, Storm runoff, Precipitation (Atmospheric), Flood damage.
Identifiers: *Sudbury River (Mass), *Assabet River (Mass), *Concord River (Mass), *Concord (Mass).

The areas flooded by the Sudbury, Assabet, and Concord Rivers, Massachusetts, in March 1968 are shown by a 2-sheet hydrologic atlas consisting of maps, tables, frequency graphs, hydrographs, and text. During a 3-day period from March 17 to 19, 1968, a total of 3 to 7 inches of rain fell on parts of eastern Massachusetts. This heavy rainfall, combined with the generally wet antecedent conditions of the spring season and some runoff from snowmelt, caused considerable flooding of the rivers in the area. The purpose of this report is to show flood stages and areas inundated by the March 1968 flood, to compare the severity of this flood with past floods, and to show the frequency of floods of given magnitudes which may be expected in the future at gaging stations in the basins. (Knapp-USGS)
W71-04980

FLOOD OF JUNE 1967 AT GRAND ISLAND, NEBRASKA,
Geological Survey, Washington, D.C.
F. Butler Shaffer, and Kenneth J. Braun.
For sale by US Geological Survey, Washington, DC 20402 - Price $0.75. Geological Survey Hydrologic Investigations Atlas HA-352, 1 sheet, 1970. Text, 2 fig, 2 photo, 2 map.

Descriptors: *Floods, *Nebraska, *Antecedent precipitation, Rainfall-runoff relationships, Surface-groundwater relationships, Hydrologic data, Overflow, Storm runoff, Precipitation (Atmospheric), Flood damage.
Identifiers: *Grand Island (Nebr).

Flooding in 1967 at Grand Island, Nebraska is shown by a 1-sheet hydrological atlas consisting of a map of the flooded area, profiles, and text. Rain on June 13-15, 1967, was the immediate cause of widespread flooding in northeastern Hall and western Merrick Counties, Nebr. The inundated areas included parts of the city of Grand Island, (population, 30,675), part of the Cornhusker Ordnance Plant, and extensive tracts of rich agricultural land. The Abbott and Grand Island quadrangles lie almost wholly on the broad, nearly flat floor of the Platte River valley. The flooding occurred in the drainage basins of Wood River, Warm Slough, and Prairie Creek, each of which is tributary to the Platte River downstream from the map area. During the period May 26 to June 12, a succession of rains totaling 7 to 10 1/2 inches fell in the area. Most of the precipitation was absorbed by the terrain. On the thoroughly soaked grounds, 2 to more than 6 inches of rain fell on June 13-15. Extensive flooding was the result. North Channel and Wood River are incised less than 5 feet below the land surface. Because the antecedent precipitation had raised the water table to or above their channel floors, runoff from the additional rain soon had both streams overflowing. (Knapp-USGS)
W71-04981

SIMULATION THEORY APPLIED TO WATER RESOURCES MANAGEMENT,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 06A.
W71-05042

ANALYSIS OF WATER TEMPERATURE VARIATIONS IN LARGE RIVER,
Illinois State Water Survey, Peoria.
For primary bibliographic entry see Field 02K.
W71-05048

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1969,
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-05049

THE BREAKING OF WATER WAVES,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
Roland K. Price.
Journal of Geophysical Research, Vol 76, No 6, p 1576-1581, February 20, 1971. 6 p, 2 fig, 10 ref.
NSF Grant GA 1187 ONR Grant 1467-0103-0020.

Descriptors: *Waves (Water), *Surf, Currents (Water), Flow, Hydraulics, Ocean waves, Shores, Beaches.
Identifiers: *Corner flow.

A steady progressive wave of maximum amplitude can be defined as a wave that has a corner flow at its crest. An analytical examination of the response of such a corner flow to certain perturbations gives a realistic description of the breaking of a spilling breaker. In particular it is shown that breaking will occur in the direction of propagation of the wave. (Knapp-USGS)
W71-05055

BOTTOM DRIFT FOR THE SOLITARY WA
Florida Univ., Gainesville. Dept. of Coastal Oceanographic Engineering.
For primary bibliographic entry see Field 02J.
W71-05056

EXPERIMENTAL FLUME INVESTIGATION HYDRAULIC TRANSIENTS IN RIVER-RES VOIR SYSTEMS,
Tennessee Univ., Knoxville.
Milind S. Bhargave.
M Sc Thesis, Tennessee University Grad School, December 1969. 43 p, 13 fig, 6 tab, 1 OWRR Project B-005-TENN (2).

Descriptors: *Unsteady flow, *Model stu *Flumes, *Hydraulic transients, *Rivers, characteristics, Reservoir, Test proced Research equipment, Methodology, Computer grams, Mathematical models, Equations, Str flow, Waves (Water), Velocity, Time, S discharge relations, Hydraulic models, Hydr similitude.
Identifiers: Flood waves.

Since 1966 the Tennessee Valley Authority been using a one-dimensional mathematical m known as the 'Simulation of Open Cha Hydraulics,' to solve the basic equations of steady flows in reservoirs and rivers. The validi this model in describing wave motion in an channel was studied. A 62-foot-long, 1 foot foot, cross-sectional plexiglas flume was bui perform the experiments. The computer prog output which predicts temporal and spatial v tions in water surface elevations and mean ve ties was compared to experimental water sur elevations and mean velocities. Transient wave tions were created by time-varying discharge the upstream and downstream ends. The exp mental results compared satisfactorily with t obtained by using the mathematical m (Woodard-USGS)
W71-05087

THE STREAMFLOW DATA PROGRAM IOWA - EVALUATION OF THE PA PROPOSAL FOR THE FUTURE,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 07C.
W71-05093

MORPHOLOGY OF THE SLIMS RIVER,
New York State Univ. College, Fredonia.
For primary bibliographic entry see Field 02J.
W71-05101

ICEFIELD RANGES RESEARCH PROJ SCIENTIFIC RESULTS, VOLUME 1,
American Geographical Society, New York, Arctic Inst. of North America, Montreal (Queb
For primary bibliographic entry see Field 02C.
W71-05103

OCEANIC HEAT CONTENT OFF OREGON: VARIATIONS AND THEIR CAUSES,
Oregon State Univ., Corvallis. Dept. of Ocean raphy.
James G. Pattullo, Wayne V. Burt, and Sally A. Kulm.
Limnology and Oceanography, Vol 14, No 279-287, March 1969. 9 p, 4 fig, 3 tab, 5 ref. Grant GP-5165; ONR Research Contract N 1286 (10).

Descriptors: *Water temperature, *Bathythen graphs, *Sea water, *Oregon, Variability, Oc currents, Currents (Water), Water circulat Oceanography, Statistical methods, Sampling, D collections.

Heat control, surface to 100 m, was computed oceanographic stations within 165 nautical mile the Oregon coast. Mean content, 1962 thro

5, was 100 kg cal per sq m, with a root mean are deviation of 13 kg cal per sq cm. The prinal fluctuation around the mean was seasonal; the sonal range among monthly mean values was ce as large offshore, beyond 100 miles from the st (35 kg cal per sq cm) as the range inshore, in 65 miles of shore (15 kg cal per sq cm). The se of the seasonal variation offshore was local ting, but advection was important inshore. Obed ranges in heat storage inshore were only a d as large as expected from the computed local ting. The results are consistent with inshore curs from the south in winter and coastal uping associated with offshore transport of water heat in summer. Inshore the seasonal regime not dominant; fluctuations of long and short ods and geographical variations were also apciable. (Knapp-USGS)
1-05105

TER RESOURCES AND GEOLOGY OF OUCESTER COUNTY, NEW JERSEY,
logical Survey, Trenton, N.J.
primary bibliographic entry see Field 02F.
1-05110

IE CHARACTERISTICS OF THE THERL REGIME OF RIVERS IN THE DANUBE DNIESTER BASINS,
ainskii Nauchno-Issledovatelskii rometeorologicheskii Institut, Kiev (USSR).
. Dyukel.
et Hydrology, Selected Paper No 4, p 381-387, . 4 fig, 4 tab, 5 ref.

criptors: *Groundwater recharge, *Water temture, River basins, Elevation, Air temperature, rmocline, Temperature, Water pollution ces.
tifiers: *Thermal regime, *Danube river basin, iester river basin.

thermal regime of rivers in the Tissa, Seret, , and Dniester basins is determined by climatic litions and, primarily, by air temperature. After ysing extensive data it is concluded, that when ralizing the characteristics of the thermal ne, allowance must be made for the influence cal conditions, especially for strong groundr recharge and human activity, which are uently more important than climatic factors actually determine the thermal regime in a reach of a water course. For example, the nal regime in a river reach with strong groundr recharge is determined by the percentage temperature of groundwater in the total flow. rivers whose basin is located in the mountains piedmont areas, elevation is an integrating r, determining their thermal regime in reaches moderate groundwater recharge. (Upada-Vanderbilt)
-05141

TISTICAL RELATIONSHIPS BETWEEN RM AND URBAN WATERSHED CHARACISTICS,
State Univ., Logan. Water Research Lab.
primary bibliographic entry see Field 04A.
-05144

OD PLAIN DELINEATION WITH PAN AND OR,
onsin Univ., Madison. Department of Soil ice.
primary bibliographic entry see Field 07B.
-05145

Groundwater

OSITY AND DISPERSION CONSTANT CULATIONS FOR A FRACTURED CAR-

BONATE AQUIFER USING THE TWO WELL TRACER METHOD,
Geological Survey, Denver, Colo. Water Resources Div.
D. B. Grove, and W. A. Beetem.
Water Resources Research, Vol 7, No 1, p 128-134, February 1971. 7 p, 3 fig, 6 ref.

Descriptors: *Hydrogeology, *Carbonate rocks, *Fractures (Geology), *Tracers, Karst, Groundwater movement, Tracking techniques, Flow nets, Pumping, Withdrawal, Water wells, Aquifers, New Mexico, Limestones, Dispersion, Diffusion, Permeability, Porosity, Storage coefficient, Radioactivity techniques, Tritium.
Identifiers: *Aquifer tests, *Pumping tests.

The time concentration profile from the discharging well of a labeled recharging-discharging well pair is used to evaluate an aquifer's porosity and dispersion constant. The technique is applicable for pulse tracer injection and recirculation. Derived equations allow prediction of streamline arc lengths and travel times between wells along streamlines. Adjacent streamlines joining the two wells define volumes that approximate dispersion columns of known length. The summation of breakthrough curve concentration profiles for flow through these individual columns provides a composite breakthrough curve for the entire flow field. Analysis of a tracer test using tritium in a fractured carbonate aquifer near Carlsbad, New Mexico, provided a dispersion constant of 125 feet and a porosity of 12.0%, values consistent with known properties of the aquifer. (Knapp-USGS)
W71-04859

PERTURBATION SOLUTIONS OF THE DISPERSION EQUATION IN POROUS MEDIUMS,
Technion-Israel Inst. of Tech., Haifa.
Gedeon Dagan.
Water Resources Research, Vol 7, No 1, p 135-142, February 1971. 8 p, 3 fig, 18 ref.

Descriptors: *Dispersion, *Porous media, *Groundwater movement, Equations, Hydrogeology, Darcys law, Mathematical studies, Boundary layers, Flow nets, Flow, Velocity, Percolation, Steady flow, Tracers.
Identifiers: Dispersion equations.

The solution of the dispersion equation for porous media is difficult because of the dependence of the dispersion tensor on the velocity. Approximate solutions of dispersion in nonuniform two-dimensional flows are sought by perturbation expansions. An inner boundary layer solution for the transition zone between two fluids in steady and unsteady conditions is derived. Two examples of dispersion, radial flow and coastal aquifers, are solved approximately. (Knapp-USGS)
W71-04860

INFLUENCE CHART FOR REGIONAL PUMPING EFFECTS,
Hydrologic Commission of the Valle de Mexico Basin, Mexico City.
For primary bibliographic entry see Field 04B.
W71-04867

SINGLE-WELL TECHNIQUE USING P-32 FOR DETERMINING DIRECTION AND VELOCITY OF GROUNDWATER FLOW,
Middle Eastern Regional Radioisotope Center for the Arab Countries, Cairo, United Arab Republic.
I. B. Hazzaa.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/44, p 713-724, 1970. 12 p, 7 fig, 12 ref.

Descriptors: *Groundwater movement, *Tracers, *Tracking techniques, Radioactivity techniques, Radioisotopes, Phosphorus radioisotopes, Tagging, Flow, Boreholes, Water wells.
Identifiers: *Radiographic techniques.

A radiographic method for determining the direction and the velocity of groundwater flow was developed. The radioisotope P-32 is injected, as a point or a thin-column source, at the center of the well. The injection is performed at the desired depth without disturbing the water. The radioisotope is left to follow the horizontal flow of water. Some of the P-32 is adsorbed onto the walls of two parallel detecting screens which are separated by a few centimeters and fitted inside the well. Both the inner and outer screens are radiographed; the darkest parts of the emulsions and the north direction marked on another film give the flow direction. The blackening of each film in the screen is measured. Velocities are determined either by the displacement method or from the calibration curve of the velocity versus relative blackening. (Knapp-USGS)
W71-04878

METHOD OF DETERMINING LEAKAGE VELOCITIES THROUGH THE BOTTOM OF RESERVOIRS,
Institute of Nuclear Physics, Cracow, Poland.
For primary bibliographic entry see Field 04A.
W71-04880

COMPARISON OF HYDROLOGICAL AND MATHEMATICAL METHODS IN ANALYSIS OF TRITIUM DATA,
Federal Experimental and Research Institute Arsenal, Vienna, and Technical High School, Vienna, Austria.
For primary bibliographic entry see Field 07C.
W71-04881

CONTRIBUTION TO THE SELECTION OF RADIOACTIVE TRACERS FOR HYDROGEOLOGY (FRENCH),
Bureau of Geological and Mining Research (BRGM), Paris, France, and Commission of European Communities, Brussels, Belgium.
For primary bibliographic entry see Field 07B.
W71-04883

RADON IN GROUNDWATERS OF DOLOMITIC AND CALCAREOUS AQUIFER IN APULIA (SOUTHERN ITALY),
CNEN, Laboratory for the Application of Radioisotopes to Hydrogeology, Bari, and Bari Univ., Italy.
For primary bibliographic entry see Field 02K.
W71-04884

SILICON-32 HYDROLOGY,
Tata Inst. of Fundamental Research, Bombay, India.
For primary bibliographic entry see Field 02K.
W71-04885

A COMPUTER-ORIENTED GENERALIZED POROSITY-LITHOLOGY INTERPRETATION OF NEUTRON, DENSITY AND SONIC LOGS,
Gulf Research and Development Co., Pittsburgh, Pa.
For primary bibliographic entry see Field 07C.
W71-04889

THE CENOMANIAN-TURONIAN CALCAREOUS AQUIFER OF CENTRAL AND WESTERN GALILEE, ISRAEL,
Geological Survey of Israel, Jerusalem.
U. Kafri.
International Association of Scientific Hydrology Bulletin, Vol 15, No 4, p 77-91, December 1970. 15 p, 7 fig, 3 tab, 31 ref.

Descriptors: *Aquifers, *Water circulation, *Karst, Recharge, Discharge (Water), Water balance, Water circulation, Springs, Permeability, Hydrogeology, Water chemistry, Water quality, Bicarbonates, Salinity, Groundwater movement.
Identifiers: *Israel.

The regional Cenomanian-Turonian aquifer of central and Western Galilee is devided into two partly connected subaquifers. The different rates of karstic erosion in the subaquifers depend on differences in lithology, initial porosity, degree of exposure and structural position. The springs of Western Galilee are natural outlets, some of them draining the lower subaquifer and some the upper one. Those that drain the upper subaquifer show a rapid decay and a good correlation with precipitation. Those of the lower subaquifer show a relatively slow decay and point to a large storage. Replenishment equations, as well as average replenishment estimates, were obtained for three out of five of the springs. The groundwaters of this area are generally of the bicarbonate type with low salinity, typical of an intake area. The salinity increases toward the base levels to the west and the south, where the waters become of the chloride type. In some places the high salinities could be related to the mixing of fresh water with small amounts of sea water. (Knapp-USGS)
W71-04900

MATHEMATICAL MANAGEMENT MODEL--UNCONFINED AQUIFER,
Texas Tech Univ., Lubbock. Water Resources Center; and High Plains Underground Water Conservation District No. 1, Lubbock, Tex.
Albert Sechrist, B. J. Claborn, Frank Rayner, and D. M. Wells.
Available from NTIS as PB-197 788, $3.00 in paper copy, $0.95 in microfiche. Final Report, October 31, 1970. 148 p, 7 tab, 23 fig, 4 append. OWRR Project C-1537 (NO 1993) (1).

Descriptors: *Groundwater, *Groundwater management, *Computer programs, *Recharge, *Model studies, *Mathematical models, Computer models, *Texas, *Aquifers, Aquifer characteristics, Wells, Withdrawal, Drawdown, *Consumptive use, Underground storage.
Identifiers: *Ogallala aquifer, Southern High Plains (Texas).

The numerical model for groundwater flow developed by the California Department of Water Resources (DWR) was adapted to a 2290 square mile region of the Ogallala Aquifer in the Southern High Plains of Texas. A computer program was written to define Theissen type polygons around each of 183 observation wells. Model verification was based on a five year period. Net withdrawals for this period were estimated from consumptive use calculations. The model is more sensitive to net withdrawal variations than to either permeability or storage coefficient variations. Constant values of aquifer properties and a six element consumptive use vector yielded an average error of 0.07 feet after five years, and a standard deviation of 9.1 feet. A recharge operation in one segment of the study area is used as an example of usefulness of the model. (Claborn-Texas Tech)
W71-04931

HYDROLOGIC AND PHOTOGEOLOGIC DETERMINATION OF RAINFALL, RUNOFF, AND GROUNDWATER RELATIONSHIPS IN A DOLOMITE AREA,
Missouri Water Resources Research Center, Rolla; and Missouri Water Resources Research Inst., Rolla.
For primary bibliographic entry see Field 02A.
W71-04937

THE PRE-QUATERNARY SURFACE IN THE JORDAN VALLEY, UTAH,
Geological Survey, Salt Lake City, Utah; and Geological Survey, Denver, Colo.
Ted Arnow, Richard Van Horn, and Reed LaPray.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D257-D261, 1970. 5 p, 1 fig, 8 ref.

Descriptors: *Aquifers, *Utah, Quaternary period, Alluvium, Groundwater, Water resources development, Stratigraphy, Limestones, Clays, Sands, Gravels, Water levels, Transmissivity, Logging (Recording), Subsurface investigations, Hydrogeology.
Identifiers: *Jordan Valley (Utah).

The altitude of the base of the Quaternary deposits in the Jordan Valley, Utah, was determined by interpretation of drillers' logs of water wells supplemented with some geological and geophysical data. The pre-Quaternary surface of the valley generally was similar to the present land surface but had considerably more relief. A map showing contours of the base of the Quaternary deposits can be used as a general guide for water-well drilling and for preliminary determination of the depth to firmest foundation materials. (Knapp-USGS)
W71-04970

A METHOD FOR RELATING INFILTRATION RATES TO STREAMFLOW RATES IN PERCHED STREAMS,
Geological Survey, Tucson, Ariz.
D. E. Burkham.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D266-D271, 1970. 6 p, 3 fig, 6 ref.

Descriptors: *Surface-groundwater relationships, *Alluvial channels, *Infiltration, *Recharge, *Permeability, Water levels, Stage-discharge relations, Discharge (Water), Streamflow, Water levels, Unsteady flow, Duration curves, Hydrograph analysis, Conjunctive use.
Identifiers: Perched water.

A method was developed for relating infiltration rates to streamflow rates for streams that are perched above the water table. The equations derived are based on relations of streamflow rates to width, depth, and velocity and on the assumed relations between infiltration velocity and these parameters. The equations were compared to measured streamflow data for a reach of an ephemeral stream entrenched in alluvium. The bed of the stream normally is coated with fine-grained material deposited during periods of low flow. An equation based on the assumption that infiltration velocity is proportional to stream depth seems to correlate closely with infiltration rates during typical short-duration flows. The layer of fine-grained material on the streambed probably is the main control on the infiltration velocity during these flows. (Knapp-USGS)
W71-04971

THE EFFECT OF STREAM DISCHARGE ON STREAMBED LEAKAGE TO A GLACIAL OUTWASH AQUIFER,
Geological Survey, Columbus, Ohio.
Stanley E. Norris.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D262-D265, 1970. 4 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Surface-groundwater relationships, *Induced infiltration, *Alluvial channels, *Ohio, Water level fluctuations, Withdrawal, Transmissivity, Glacial drift, Recharge, Discharge (Water), Water yield, Streamflow, Water levels.
Identifiers: *Aquifer testing, *Pumping tests.

Five controlled pumping tests of a glacial outwash aquifer, made in a comparatively small area in the Scioto River valley near Piketon, Ohio, showed ranges in aquifer transmissivity from 165,000 to 300,000 gallons per day per foot and in the streambed leakage from 0.21 to 1.15 mill lons per day per acre for each foot of h ference between the stream and the un aquifer. The rate of streambed leakage var stream discharge and velocity, suggesti higher flows progressively clean the stream increase its permeability. The relation of di to streambed leakage is important not onl design of local groundwater supply facilit also because it may be applicable to a large the watercourse aquifer system in the lowe River valley. (Knapp-USGS)
W71-04973

VERTICAL MOLECULAR DIFFUSIO XENON-133 GAS AFTER INJECTIO DERGROUND,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 05
W71-04977

WATER RESOURCES OF THE GREAT S MOUNTAINS NATIONAL PARK, TENN AND NORTH CAROLINA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02
W71-04979

HYDROLOGY AND GEOLOGY OF HONOLULU AQUIFER,
California Univ., Berkeley. Dept. of Civil En ing; and General Electric Co., Santa Barbara TEMPO.
David K. Todd, and Charles F. Meyer.
ASCE Proceedings, Journal of the Hydraulic sion, Vol 97, No HY2, Paper 7910, p 23 February 1971. 24 p, 13 fig, 6 tab, 28 ref, a OWRR Project B-041-CAL (3).

Descriptors: *Saline water intrusion, *I *Aquifers, *Water resources development, water-freshwater interfaces, Groundwater ment, Drawdown, Water levels, Basalts, flow, Unsteady flow, Pumping, Water Stratified flow, Water management (Ap Saline water systems.
Identifiers: Honolulu aquifer (Hawaii).

In one sub-basin of the highly permeable forming the Honolulu aquifer, the freshwat floats upon and mixes with underlying sea has been withdrawn at rates exceeding the su ble yield, causing shallow drawdown cone severe upconing of brackish water. Recharg the area is estimated by three different m and found to be about 5.3 mgd. By the Thei equilibrium method permeability of the ba estimated to be 13,700 gpd per sq ft. Relative permeable caprock deposits appear to limit le of freshwater to the ocean or to adjacent a areas to negligible amounts, since withdrawal proximately the estimated recharge rate cau increase in salinity. This study is part of a pro develop a mathematical model and to simul use of a digital computer the dynamic behav isochlors when freshwater floats on salt wate napp-USGS)
W71-05043

STEADY STATE FLOW AROUND A WELL TWO-LAYERED AQUIFER,
Iowa State Univ., Ames. Dept. of Agronomy.
Muhammad Yunus Khan, Don Kirkham, and Toksoz.
Water Resources Research, Vol 7, No 1, p 165, February 1971. 11 p, 7 fig, 2 tab, 1 OWRR Project B-013-IA (4).

Descriptors: *Groundwater movement, *Aqu *Withdrawal, *Hydrogeology, *Drainage Equations, Mathematical studies, Permeal Isotropy, Drawdown, Recharge, Drainage sys Pumping, Subsurface drainage, Water table, rated flow, Computer programs, Steady Uniform flow, Hydraulic conductivity.

dentifiers: Groundwater-soil water relationships.

Theoretical expressions for the hydraulic head and he stream function are derived for three-dimen-ional, axisymmetric steady flow around a well in a wo-layered aquifer. The aquifer receives a steady ertical recharge, and the well is pumped at a con-tant rate; the hydraulic head at the outer cylindri-al boundary is kept constant. Two sets of flow nets nd a table of values are presented to show the ef-ect of hydraulic conductivities of the two layers on low lines, equipotentials, and the height of the ater table. Graphs show the effect of the problem ariables on the height of the water table. (Knapp-SGS)
71-05044

PACING OF DRAINAGE WELLS IN A AYERED AQUIFER,
owa State Univ., Ames. Dept. of Agronomy.
luhammed Yunus Khan, and Don Kirkham.
/ater Resources Research, Vol 7, No 1, p 166-83, February 1971. 18 p, 5 fig, 2 tab, 10 ref, 2 ap-end. OWRR Project B-013-IA (5).

escriptors: *Groundwater movement, *Aquifers, Withdrawal, *Hydrogeology, *Drainage wells, quations, Mathematical studies, Permeability, otopy, Drawdown, Recharge, Drainage systems, umping Subsurface drainage, Water table, Satu-ted flow, Computer programs, Steady flow, niform flow.
entifiers: Groundwater-soil water relationships.

theory is presented to determine spacing of entical drainage wells that, by discharging oundwater simultaneously from a layered uifer, will lower a water table to a preassigned vel and maintain it. The theory has been veloped by solving a mathematical boundary lue problem. The wells are located on a certain gular grid, and the aquifer receives a uniform ver-al recharge from rainfall or excess irrigation. The eory shows that the spacing depends on the ckness and hydraulic conductivity of each rmeable layer tapped by the wells, the maximum owable drawdown, the uniform vertical charge, the radius of the wells, and the well grid ometry. A table of values of a function, useful for termining spacing of wells to be tapped in an uifer that may consist of any number of permea-layers, is given. (Knapp-USGS)
71-05045

BJECTIVES OF A CURRENT STUDY OF LINE GROUNDWATER IN THE TULAROSA SIN, NEW MEXICO,
ological Survey, Albuquerque, N. Mex.
r primary bibliographic entry see Field 04B.
71-05067

CORDS OF WATER-LEVEL MEASURE-NTS IN WELLS IN GALVESTON COUNTY, XAS, 1894-1969.
ological Survey, Houston, Tex.
primary bibliographic entry see Field 07C.
71-05069

CORDS OF WATER-LEVEL MEASURE-NTS IN WELLS IN HARRIS COUNTY, TEX-1966-1969.
ological Survey, Houston, Tex.
primary bibliographic entry see Field 07C.
1-05070

OLOGY AND HYDROLOGY OF SELECTED AYAS IN WESTERN UNITED STATES.
ssachusetts Univ., Amherst. Dept. of Geology.
primary bibliographic entry see Field 02J.
1-05073

GEOLOGY AND HYDROLOGY OF ROGERS PLAYA AND ROSAMOND PLAYA, CALIFORNIA,
Massachusetts Univ., Amherst. Dept. of Geology; and Mobil Oil Corp., Shreveport, La.
For primary bibliographic entry see Field 02J.
W71-05074

GEOLOGY AND HYDROLOGY OF COYOTE PLAYA,
Massachusetts Univ., Amherst. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-05075

RESULTS OF TEST-DRILLING AND WINTER MAPPING PROGRAMS ON COYOTE PLAYA, CALIFORNIA,
Massachusetts Univ., Amherst. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-05076

RECONNAISSANCE GEOLOGY OF BIG SMOKY PLAYA, NEVADA,
Chevron Oil Co., Jackson, Miss.
For primary bibliographic entry see Field 02J.
W71-05077

GEOLOGY AND HYDROLOGY OF TROY PLAYA, SAN BERNARDINO COUNTY, CALIFORNIA,
Texas Univ., Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 02J.
W71-05078

RECONNAISSANCE GEOLOGY OF CLAYTON PLAYA, NEVADA,
Shell Oil Co., Midland, Tex.
For primary bibliographic entry see Field 02J.
W71-05079

SOME HYDROLOGIC AND GEOLOGIC PROCESSES INFLUENCING PLAYA DEVELOPMENT IN THE WESTERN PART OF THE BASIN AND RANGE PROVINCE, UNITED STATES,
Massachusetts Univ., Amherst. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-05080

GROUNDWATER RESOURCES OF THE CLATSOP PLAINS SAND-DUNE AREA, CLATSOP COUNTY, OREGON,
Geological Survey, Washington, D.C.
F. J. Frank.
For sale by the Superintendent of Documents, US Government Printing Office, Wash, DC, 20402 - Price $1.00. Geological Survey Water-Supply Paper 1899-A, 1970. 41 p, 8 fig, 1 plate, 8 tab, 15 ref.

Descriptors: *Water resources, *Groundwater, *Oregon, Hydrogeology, Hydrologic data, Data collections, Geology, Water wells, Aquifers, Aquifer characteristics, Water table, Water yield, Water quality, Chemical analysis, Water pollution sources, Saline water intrusion, Drawdown, Surface-groundwater relationships, Water resources development, Hydrographs.
Identifiers: *Clatsop county (Oregon), Clatsop Plains.

Although the average annual precipitation of the Clatsop Plains is 78.5 inches, the area has some water supply problems. The area is underlain by Tertiary bedrock of low permeability that stores and yields small quantities of groundwater, which may be of poor chemical quality. This Tertiary bedrock furnishes only minor groundwater discharge to maintain the base flow of streams. The lowlands are overlain by extensive deposits of dune and beach sand that can absorb and store a large percentage of the annual precipitation. In the central part of the dune area, the saturated thickness of the sand ranges from 95 to more than 150 feet. Much of the water now being discharged to the ocean could be recovered by pumping. Three test wells drilled are capable of yielding 100 gallons per minute. It is estimated that 2,500 acre-feet of groundwater per year per square mile of area may be available for withdrawal in the 10-square mile area that is most favorable for development. The water from the dune sand is soft to moderately hard, has a low chloride concentration, and is of generally good chemical quality. Groundwater from shallow depths beneath a few swampy areas is brown and contains excessive concentrations of iron. (Woodard-USGS)
W71-05088

ELECTRICAL-ANALOG-MODEL STUDY OF WATER RESOURCES OF THE COLUMBUS AREA, BARTHOLOMEW COUNTY, INDIANA,
Geological Survey, Washington, D.C.
F. A. Watkins, Jr., and J. E. Heisel.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $1.25. Geological Survey Water-Supply Paper 1981, 1970. 22 p, 4 fig, 3 plate, 11 tab, 14 ref.

Descriptors: *Groundwater, *Water resources development, *Analog models, *Indiana, Aquifers, Glacial drift, Aquifer characteristics, Water yield, Specific capacity, Withdrawal, Hydrogeology, Hydrologic data, Water wells, Water levels, Water supply, Forecasting, Water resources.
Identifiers: *Columbus Area (Ind), *Bartholomew County (Ind).

The study area is in part of a glacial outwash sand and gravel aquifer that was deposited in a preglacial bedrock valley. The area extends from the north line of Bartholomew County, Indiana, to the south county line and includes a small part of Jackson County south of Sand Creek and east of the East Fork White River. This report area includes about 100 square miles of the aquifer. Groundwater in the outwash aquifer is unconfined. Results of pumping tests and estimates derived from specific-capacity data indicate that the average horizontal permeability for this aquifer is about 3,500 gallons per day per square foot. An average coefficient of storage of about 0.2 was determined from pumping tests. Transmissibilities range from near zero to about 500,000 gallons per day per foot in the thicker parts of the aquifer. About 800,000 acre-feet of water is in storage in the aquifer. This storage is equivalent to an average yield of 34 million gallons per day for about 21 years without recharge. An electrical-analog model indicates that there is more than enough water to meet the estimated needs of the city of Columbus without seriously depleting the aquifer. The decline in water levels in the Columbus area as predicted by the model for the period 1970-2015 ranged from about 20 feet in the center of the areas of pumping to 3 feet or less in the areas upstream and downstream from these areas of pumping. (Woodard-USGS)
W71-05092

WATER RESOURCES AND GEOLOGY OF GLOUCESTER COUNTY, NEW JERSEY,
Geological Survey, Trenton, N.J.
William F. Hardt, and George S. Hilton.
New Jersey Division Water Policy and Supply Special Report 30, 1969. 130 p, 17 fig, 9 tab, 6 ref.

Descriptors: *Water resources, *Groundwater, *Geology, *New Jersey, Hydrologic data, Water wells, Aquifers, Water yield, Water quality, Data collections, Water levels, Hydrology, Pumping, Water utilization, Water users, Consumptive use, Hydrographs, Aquifer characteristics, Surface waters, Streamflow, Drainage, Low flow, Water table, Precipitation (Atmospheric), Surface-groundwater relationships.
Identifiers: *Gloucester County (N.J.).

Gloucester County, in the southwestern part of New Jersey adjacent to Philadelphia, Pa., Camden, N. J., and Wilmington, Del. in the lower Delaware River valley, has an area of 339 square miles. It is in the Coastal Plain physiographic province and is underlain by unconsolidated sand and clay of Quaternary, Tertiary, and Cretaceous age. These sediments overlie bedrock which consists of metamorphic and igneous rocks of upper Precambrian age. The most important and productive aquifer is the undifferentiated Raritan and Magothy Formations of Late Cretaceous age. The aquifer yields about 75 percent of the groundwater used in the county. Wells tapping this aquifer yield up to 1,400 gpm (gallons per minute). Total groundwater pumpage in the county (1966) was estimated at about 40 mgd which consisted of 15.5 mgd for industrial use; 11 mgd for public supplies; 10 mgd for irrigation; and 3.5 mgd for rural domestic supplies. The chemical quality of groundwater is generally acceptable for most uses, although in some areas objectionable amounts of iron, nitrate, and fluoride are found. Near the Delaware River and in the southeastern part of the county, chloride in the water from the Raritan and Magothy Formations may be a future problem. (Woodard-USGS)
W71-05110

APPROXIMATE SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR FLOW THROUGH A RECTANGULARLY PACKED BED OF SPHERES,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
William McKinley Carson.
PhD Thesis, Idaho University, August 1970. 180 p, 26 fig, 3 tab, 58 ref, 3 append. OWRR Project A-025-IDA (1).

Descriptors: *Groundwater movement, *Numerical analysis, *Computer programs, Equations, Flow, Porous media, Reynolds number, Velocity, Viscosity, Mathematical studies, Percolation, Approximation method.
Identifiers: *Navier-Stokes equations.

Approximate solutions for the Navier-Stokes equations describing fluid flow through a rectangular packing of spheres were obtained for Reynolds numbers of 0.1, 1, 7 and 35. The solutions are based on an Oseen linearization of the full Navier-Stokes equations. The solutions were approximated by triple trigonometric series and the unknown coefficients evaluated using the Galerkin method for error distribution. Friction factors for the packed bed and superficial velocity were evaluated from the velocity functions and are shown to agree with the experimental observations of previous investigators. Based on friction factor and superficial velocity, the Oseen linearization is shown to be valid for packed flow at Reynolds number of 35. (Knapp-USGS)
W71-05111

2G. Water in Soils

SOIL MOISTURE DETECTION WITH IMAGING RADARS,
Kansas Univ., Lawrence. Remote Sensing Lab.
For primary bibliographic entry see Field 07B.
W71-04857

HYSTERESIS DURING INFILTRATION AND REDISTRIBUTION IN A SOIL COLUMN AT DIFFERENT INITIAL WATER CONTENTS,
Grenoble Univ. (France). Dept. of Hydrology.
Georges Vachaud, and Jean-Louis Thony.
Grant 69-01-666 from General Delegation of Scientific and Technical Research, Paris. Water Resources Research, Vol 7, No 1, p 111-127, February 1971. 17 p, 15 fig, 34 ref.

Descriptors: *Hysteresis, *Infiltration, *Evaporation, *Percolation, *Soil water movement, Unsaturated flow, Hydraulic conductivity, Soil physical properties, Saturated flow, Permeameters, Recharge, Soil moisture meters, Nuclear moisture meters, Tensiometers, Gamma rays, Moisture content.
Identifiers: Soil water redistribution.

Experimental results dealing with flow processes involving hysteresis effects in the suction-water content relationship were obtained on a vertical column of soil submitted to the following successive controlled flow conditions: (1) redistribution of water following a constant head infiltration in an initially air-dried column, (2) constant head infiltration followed by redistribution, and (3) constant flux infiltration followed by controlled evaporation and redistribution. Water contents were measured by using gamma ray attenuation, and water suctions were obtained simultaneously from 10 pressure transducers distributed along the soil column, each one being connected to a tensiometer. All the data were punched on tape and treated with a computer. Examination of the changes of water content and water suction at a given depth yielded precise information on hysteretic behavior. The scanning curves for a single reversal can be defined uniquely with reference to the transition water content, the independent domain theory appears to be inadequate for describing soil water hysteresis completely, and hydraulic conductivity can be considered practically unique. (Knapp-USGS)
W71-04858

FLOW THROUGH A TAILINGS POND EMBANKMENT,
Bureau of Mines, Spokane, Wash., and Idaho Univ., Moscow.
For primary bibliographic entry see Field 08D.
W71-04862

FLOW CELL SYSTEM FOR MISCIBLE DISPLACEMENT EXPERIMENTS,
Iowa State Univ., Ames.
Sun-HO Yoo, and Don Kirkham.
Water Resources Research, Vol 7, No 1, p 211-213, February 1971. 3 p, 2 fig, 3 ref. USAEC Contract AT-(11-1)-1269, Report C00-1269-23.

Descriptors: *Soil water movement, *Permeameters, *Tracers, *Tracking techniques, Nuclear meters, Gamma rays, Dispersion, Diffusion, Mixing, Porous media, Steady flow, Laboratory tests, Data collections, Data processing.
Identifiers: Miscible displacement.

Use of a scintillation counting system gives a continuous graphical recording of effluent concentration, as measured by scintillation counts of radioactivity per minute, of a tracer labeling a chemical component of a solution that miscibly displaces another solution in a column of porous medium. The continuous graphical recording, when the horizontal and vertical axes are assigned proper units, gives a breakthrough curve for the miscible displacement process. The equipment obviates the use of fraction collectors. (Knapp-USGS)
W71-04868

CLAY MINERALS IN CALICHE DEPOSITS OF EASTERN NEW MEXICO,
Harvard Univ., Cambridge, Mass. Dept. of Geological Sciences.
L. F. Aristarain.
Journal of Geology, Vol 79, No 1, p 75-90, January 1971. 16 p, 9 fig, 2 tab, 57 ref.

Descriptors: *Caliche, *New Mexico, *Clay minerals, Soil formation, Mineralogy, Illite, Montmorillonite, Kaolinite, Alluvium, Weathering, Diagenesis, Leaching, Calcareous soils, Soil chemistry, Calcium carbonate, Hardpan, Soil types.
Identifiers: Calichification, High Plains (New Mexico).

Relative quantitative estimations were made of c
minerals in samples from twelve profiles of cali
deposits of eastern New Mexico. These prof
represent: High Plains (6), Sacramento Plain
Mescalero Plain (1), and Orchard Park (2)
Blackdom (2) Terraces of the Pecos River.
typical clay mineral association is illite, montmo
lonite, kaolinite, and chlorite. Randomly mi
layers of illite and montmorillonite; illite
chlorite; and illite, montmorillonite, and chlo
are present in small amounts. Illite is the m
abundant clay mineral and markedly increa
toward the top of the profiles. Illite content va
inversely with both kaolinite and montmorillon
The variations of kaolinite and montmorillonite
approximately parallel. In half of the samp
kaolinite is slightly more abundant than montmo
lonite, and the contrary occurs in the other hal
profiles of deposits with a low degree of calichif
tion, illite is the most abundant clay mineral,
the other relationships do not apply. By compar
the clay minerals present in caliche profiles w
published results for various soil types, analog
with chernozem and desert soil are noted. (Kna
USGS)
W71-04871

A NEW METHOD OF DETECTING LEAKS RESERVOIRS OR CANALS USING LABELL BITUMEN EMULSIONS (FRENCH),
CEA, Center of Nuclear Study of Grenoble,
Societe routiere Colas, Paris, France.
For primary bibliographic entry see Field 04A.
W71-04879

BIOGEOCHEMICAL INVESTIGATIONS THE RUDNYY ALTAY,
Akademiya Nauk SSSR, Moscow. Institut Ge
himii i Analiticheskoi Khimii.
For primary bibliographic entry see Field 02K.
W71-04895

REMOTE SENSING OF HYDROLOG RESOURCES IN THE GREAT PLAINS, P PORT 1,
South Dakota State Univ., Brookings. Rem
Sensing Inst.
For primary bibliographic entry see Field 07B.
W71-05091

SOME RECENT RESEARCH ON LA DRAINAGE,
Iowa State Univ., Ames. Water Resour
Research Inst., and Alexandria Univ. (Egyp
Dept. of Soil Sciences.
For primary bibliographic entry see Field 04A.
W71-05102

MINERALOGY OF A PLAYA SOIL AND U DERLYING SEDIMENTS FROM THE HI PLAINS MEDIUM-TEXTURED SOIL ZONE,
Texas Tech. Univ., Lubbock. Dept. of Soil Scien
For primary bibliographic entry see Field 02J.
W71-05112

STABILITY OF CLOSED HORIZONT DRAINAGE IN THE GOLODNAYA STEPPE,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08D.
W71-05254

TRANSPORT ANALYSIS-BASIC PREDICTI APPROACH OF THE MOVEMENT OF POLL TANTS THROUGH SOIL,
Battelle Memorial Inst., Richland, Wash. Paci
Northwest Lab.
For primary bibliographic entry see Field 05B.
W71-05264

PERCOLATION OF CITRUS WAST THROUGH THE SOIL,
Engineering--Science Inc., Arcadia, Calif.

r primary bibliographic entry see Field 05D.
1-05275

I. Lakes

ME OBSERVATIONS ON THE EFFECT OF ND INDUCED THERMAL MIXING,
katchewan Research Council, Saskatoon.
primary bibliographic entry see Field 02D.
1-04864

TER QUALITY CHARACTERISTICS OF E NEW HOPE AND LOWER HAW RIVERS Y 1966 - FEB. 1970 WITH ESTIMATES OF E PROBABLE QUALITY OF NEW HOPE KE,
th Carolina Water Resources Research Inst., eigh; and North Carolina Univ., Chapel Hill. t. of Environmental Biology.
primary bibliographic entry see Field 05B.
1-04932

ROGRAM OF RESEARCH FOR THE CAT-H FARMING INDUSTRY.
eau of Commercial Fisheries, Ann Arbor, h.

ilable from NTIS as COM-71-00049, $3.00 in er copy, $0.95 in microfiche. Economic elopment Administration Report, ACOMM-70-015, Sept 1970. 233 p.
tifiers: *Fisheries, Economic development, tfishes, *Aquaculture, Surveys, Methodology, ding stuffs, Harvesting, Processing, Marketing, d services, Ponds, Lakes, Equipment, Statisti-lata, Profits, *Fish farms.

history and current state of the industry, im-vement of harvesting methods and equipment, present and future markets including pay-lakes restaurants are reported. Research results are rted as regards catfish processing and feed-'s and diets for catfish. A survey of fish farming 2 states revealed that adult catfish were being ed on 30,330 acres, minnows on 26,866 acres, fingerling catfish on 6,782 acres. The states of issippi and Arkansas account for 75 percent of adult catfish, 74 percent of the fingerling cat-and 83 percent of the minnow acreages. There 804 fish farmers cultivating adult catfish, 429 ng fingerling catfish, and 292 rearing minnows. weighed mean stocking rate was 1,763 fish per while the module stocking rate was 1,500 fish acre. Only 23 fish farmers gave data on king rates for fingerling catfish and the weighed n stocking rate reported by them was 27,468 per acre.
-04953

PRESENCE OF TRUE HALOPHILIC BAC-IA IN WATERS OF SPRINGS AND LAKE MBON, (IN FRENCH),
re Hospitalier et Universitaire de Vienne nce).
Brisou, and Richard Moreau.
ptes Rendus Academie des Sciences, Paris, 268, No 20, p 2525-2526, 1969. 4 ref.

riptors: *Halophytes, *Freshwater, Rivers, es, Springs, Bacteria, Geologic time, Aquatic eria.
tifiers: *Lake Chambon (France), Em-bacter halmephilium, Sarcina litoralis.

rary to general beliefs, the distribution of halo-c bacteria is not confined to seas and saline and marshes. Investigations disclosed a great ber of facultative and strictly halophilic bac-in fresh water of rivers. In particular this is of spring waters of the central uplands of ce and Lake Chambon. This study identified strains of Empedobacter halmephilium and strain of Sarcina litoralis. The presence of bacteria outside of saline waters may provide information on the geological history of the (Wilde-Wisconsin)
W71-04960

DEVELOPMENTAL HISTORY OF SCHOHSEE SHOWN BY MICROSCOPICAL AND CHEMICAL INVESTIGATIONS, (IN GERMAN),
Max-Planck-Institut fuer Limnologie zu Ploen (West Germany).
Massoud A. H. Saad.
English summary. Archiv fur Hydrobiologie, Vol 67, No 1, p 32-77, 1970. 23 fig, 1 tab, 75 ref.

Descriptors: *Productivity, *Lakes, Allogenic succession, Geologic time, History, Dating, Analysis.
Identifiers: *Schohsee (Germany).

Long core samples were collected from the bottom of the Schohsee with a modified Livingstone corer. The results of pollen and chemical analyses indicated that since its origin in the late glacial time up to the Boreal period the lake had a relatively low productivity. The biogenci production increased considerably in the Atlanticum. The limnological quality of the lake persisted for about 5000 years, but in the Subatlanticum had undergone a gradual decline. In the beginning of this century, the autochthonous production was augmented by eutrophication caused by human activity. (Wilde-Wisconsin)
W71-04963

A PALEOHYDROLOGIC MODEL FOR MINERALIZATION OF THE WHITE PINE COPPER DEPOSIT, NORTHERN MICHIGAN,
Geological Survey, Beltsville, Md.
Walter S. White.
Economic Geology, Vol 66, No 1, p 1-13, January-February 1971. 13 p, 3 fig, 4 tab, 18 ref.

Descriptors: *Paleohydrology, *Mathematical models, *Groundwater movement, *Ion transport, *Water chemistry, Aqueous solutions, Geology, Copper, Geochemistry, Mineralogy, Michigan, Leaching, Water circulation.
Identifiers: *Copper ores, Keweenawan rocks.

Physical properties of the upper Keweenawas rocks can be measured or inferred within a sufficiently narrow range for quantitative evaluation of various paleohydrologic models for the origin of the White Pine copper deposit. The models involve lateral migration of fluids through the subjacent Copper Harbor Conglomerate to the site of the deposit, and stripping of copper from these solutions in the Nonesuch Shale. The calculations reveal limitations to theories of origin that would not be evident from purely qualitative consideration; some of these limitations could be useful to exploration. For example, if the water was yielded by compaction of the Copper Harbor Conglomerate and contained 50 ppm Cu, there must have been significant convergence of solution paths toward White Pine. Surface water entering the Copper Harbor Conglomerate on the north limb of the Lake Superior syncline is an adequate source if the point of entry was once significantly higher than the water table at White Pine; this model implies a major copper deposit at great depth north of the axis of the syncline. Groundwater entering the Nonesuch Shale up dip from White Pine is not a possible source of mineralizing solutions. (Knapp-USGS)
W71-05058

LAKES--RESTORATION AND PRESERVATION,
Federal Water Quality Administration, Cincinnati, Ohio. Field Investigations Branch.
For primary bibliographic entry see Field 05C.
W71-05082

SUBMERSIBLE RECORDING CURRENT AND WATER QUALITY METERS,
Ontario Water Resources Commission, Toronto.
For primary bibliographic entry see Field 05A.
W71-05084

HYDROLOGIC REGIMEN OF WALKER LAKE, MINERAL COUNTY, NEVADA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05095

EFFECTS OF THERMAL DISCHARGES ON THE MASS ENERGY BALANCE OF LAKE MICHIGAN,
Argonne National Lab., Ill.
For primary bibliographic entry see Field 05C.
W71-05119

AIRBORNE TEMPERATURE SURVEYS OF LAKE MICHIGAN, OCTOBER, 1966 AND 1967,
Michigan Univ., Ann Arbor. Great Lakes Research Div; and Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-05120

GREAT LAKES THERMAL STUDIES USING INFRARED IMAGERY,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 07B.
W71-05123

GREAT LAKES SNOWSTORMS. PART 1. CLOUD PHYSICS ASPECTS,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
For primary bibliographic entry see Field 02C.
W71-05153

GREAT LAKES SNOWSTORMS, PART 2. SYNOPTIC AND CLIMATOLOGICAL ASPECTS,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
James E. Jiusto, Douglas A. Paine, and Michael L. Kaplan.
Available from NTIS as COM-71-00011, $3.00 in paper copy, $0.95 in microfiche. May 1970. 58 p, 24 fig, 7 tab, 16 ref. ESS Grant E22-13-69 (G).
Identifiers: *Snowstorms, *Great Lakes, *Climatology, Analysis, Air water interactions, Cloud physics, Vortices, Convention, Atmospheric motion, Snow fall, Reduction, Crystals, Supercooling, Meteorological radar, Statistical analysis, Precipitation, Meteorology, Lake Erie, Lake Ontario, Lake effect snowstorms.

A secondary perturbation of trough has been found in some deep cyclonic systems which appears to play an important role in mesoscale lake effect storms. In two cases such a trough's associated positive vorticity field provided organized ascent in the region between 850 mb and 600 mb. In the November 1967 storm, air parcels traveling between the 850 mb and 700 mb levels underwent one to six thousand foot ascents. This ascent, in turn, provided a moist environment which enhanced cloud growth, nearly doubling cloud depths in the 1968 case. While examining synoptic-mesoscale interactions, it is equally important to recognize the role played by organized descent over a particular lake. Subsidence commonly occurs in the negative vorticity area located ahead of the secondary trough and behind the cold front. This descent is envisioned as effectively capping convective motions at the resulting inversion while drying out the environment beneath the stable layer. A numerical model now being developed will provide an important input of initial and changing boundary conditions for complementing meso- and microscale studies. The model's predicted vorticity field at three hour intervals will yield a measure of the changing values of a synoptically imposed vertical motion pattern, plus its subsequently created moisture environment.
W71-05154

FISH AND CRAYFISH MORTALITIES DUE TO AN INTERNAL SEICHE IN GEORGIAN BAY, LAKE HURON,
Department of Lands and Forests, Maple (Ontario). Research Branch.
For primary bibliographic entry see Field 05C.
W71-05208

FISHERY IMPLICATIONS ASSOCIATED WITH PROLONGED TEMPERATURE AND OXYGEN STRATIFICATIONS,
Arizona Cooperative Fishery Unit, Tucson.
For primary bibliographic entry see Field 05C.
W71-05209

THE TEMPERATURE STRUCTURE OF A MID-LATITUDE, DIMICTIC LAKE DURING FREEZING, ICE COVER, AND THAWING,
Cold Regions Research and Engineering Lab., Hanover, N.H.
W. H. Parrott, and W. M. Fleming.
Available from NTIS as AD-715 716, $3.00 in paper copy, $0.95 in microfiche. Research Report 291, Nov 1970. 21 p, 17 fig, 1 tab, 32 ref.
Identifiers: *Lakes, Temperature, *Ice, Lakes, Freezing, Melting, Thermocouples, Cooling, Thermal properties, Ice formation, Ice breakup, Limnology.

The temperature structure of Post Pond, a small (46.6 hectares), mid-latitude, dimictic lake in west-central New Hampshire, was studied during autumn, winter and spring of 1968-1969. The lake was instrumented over its maximum depth (11.7 m) with a string of 24 thermocouples which recorded hourly temperatures. Temperatures in 9 m of sediments underlying the lake were measured with a thermistor probe. Secondary and tertiary thermocline development in the epilimnion occurred during short warming periods in the early autumn. The autumn overturn lasted 25 days, whereas the spring overturn lasted only 4 days. The entire lake mixed isothermally in the autumn to 3.2 C. During the period of ice cover, the lower 5 m of water gained approximately 51.5 cal/cm sq, which was supplied by stored heat in the bottom sediments. A steady-state thermal gradient of 0.07 deg C/m was found for the deeper sediments underlying the lake during ice cover. Late winter cooling of bottom water under the ice cover may be the result of snowmelt in areas adjacent to the lake causing activation of groundwater influx. Melting of the clear ice portion of the ice cover was primarily the result of heat supplied to the lake from snowmelt water, and occurred on the underside of the ice sheet. Thermal instability of the water mass persisted for 9 days during peak snowmelt runoff; this can be partially explained by an increase in dissolved solids with depth.
W71-05259

2I. Water in Plants

ON THE NUTRITION AND METABOLISM OF ZOOPLANKTON. VII. SEASONAL SURVEY OF NITROGEN AND PHOSPHORUS EXCRETION BY CALANUS IN THE CLYDE SEA-AREA,
Marine Biological Association of the United Kingdom, Plymouth (England). Lab.; and Marine Biological Station, Millport (Scotland).
E. I. Butler, E. D. S. Corner, and S. M. Marshall.
Journal of the Marine Biological Association of the United Kingdom, Vol 50, No 2, p 525-560, 1970. 5 fig, 9 tab, 43 ref.

Descriptors: *Zooplankton, *Metabolism, *Absorption, Exudation, Nitrogen, Phosphorus, Consumptive use.
Identifiers: *Winter feeding, Calanus finmarchicus, Calanus helgolandicus.

Body weight, nitrogen, phosphorus, and levels of nitrogen and phosphorus excretion were determined in females, males and stage V of Calanus finmarchicus and C helgolandicus. Maximum of plant food in terms of chlorophyll a was observed in early April, mid-May, and early September. Excretion of nitrogen and phosphorus was at its peak in April. The rate of excretion was correlated with the level of nutrients. The sex and age of animals did not influence significantly the nitrogen: phosphorus ration. In late April, 26.8% of the captured nitrogen and 17.2% of phosphorus were invested in growth. The findings suggest that the concept of superfluous feeding is not applicable to Calanus during the spring period. (Wilde-Wisconsin)
W71-04965

SEASONAL CHANGES OF CALORIC VALUES OF LAKE PLANKTON, (IN RUSSIAN),
Minsk Univ. (USSR).
A. P. Ostapenya, and Yu G. Giginyak.
Doklady Akademii nauk BSSR, Vol 14, No 1, p 77-79, 1970. 1 fig, 1 tab, 6 ref.

Descriptors: *Plankton, *Energy, *Lipids, Ecosystems, Copepods, Organic matter, Daphnia.
Identifiers: *Caloric values, Belorussian lakes, Cladocerans, Diaptomus graciloides, Daphnia cucullata, Daphnia hyalina, Oscillatoria rubescens, Subglacial flowering, Winter maxima.

The caloric values of organisms serve as important indicators in appraisals of energy relations of planktonic ecosystems. In this study of Belorussian lakes of different trophic levels, the calories of copepods and cladocerans were determined during different periods of the year by a modified method of dichromate oxidation. Regardless of the nature of water, caloric value of organic matter attained its maximum in February. The high caloric values are attributed largely to accumulation of lipids in the bodies of organisms, increasing with lower temperatures from about 10 to 40%. (Wilde-Wisconsin)
W71-04966

PRIMARY PRODUCTION MEASUREMENTS ON A NATURAL PLANKTON BLOOM,
Bedford Inst., Dartmouth (Nova Scotia). Marine Ecology Lab.
Trevor Platt, and D. V. Subba Rao.
Journal Fisheries Research Board of Canada, Vol 27, No 5, p 887-899, 1970. 2 fig, 2 tab, 26 ref.

Descriptors: *Primary productivity, *Phytoplankton, *Measurement, Plankton, Test procedures, Cultures, Laboratory tests.
Identifiers: Phytoplankton blooms, Caloric values, Trichromatic equations.

The samplings were made one mile from the shore of Nova Scotia at six depths from 1 to 40 meters. Analyses included determinations of primary production by the in situ C-14 method, photosynthesis: respiration and chlorophyll c: chlorophyll a ratios, particulate carbon, ash content, phosphorus, silica, nitrates, incident radiation, and transparency. The observations suggested that culture trails provide satisfactory analogues of natural plankton systems under bloom conditions. As inferred from calorific values, phytoplankton in senescent stages of the bloom has no tendency to store fat. No single quantity served as an indicator of the physiological vigor of the plant community. (Wilde-Wisconsin)
W71-04967

THE EFFECT OF SEA WATER ON CARBON DIOXIDE EXCHANGE BY THE HALOPHYTE LIMONIUM CALIFORNICUM (BOISS.) HELLER,
Oxford Univ. (England). School of Botany; and Stanford Univ., Calif. Dept. of Biological Sciences.
S. R. J. Woodell, and H. A. Mooney.
Annals of Botany; Vol 34, No 134, p. 117-121, January 1970. 3 fig, 9 ref.

Descriptors: *Salt marshes, *Photosynthesis, *Halophytes, *Saline water, *Respiration, Carbon dioxide, Laboratory tests, Mode of action, Physiological ecology, Root systems, Environmental effects, Metabolism, Stomata.

Coastal salt marsh plants live in an environme characterized by sudden and extreme changes salt concentrations. The effects of sudden s salinity changes on photosynthesis and respirati were compared in a halophytic species and a n halophytic species. Plants of Limonium calif nicum (a salt-marsh halophyte) and Phaseolus v garis were cultivated under identical conditio and suddenly subjected to sea water around th root systems. Carbon dioxide consumption production was measured for 20 hrs. in the li and in the dark. Both species showed initial creases in photosynthetic rates immediately af introduction of sea water. In the case of Limoniu photosynthesis was 85% of the initial rate 17 h later, while respiration declined steeply, follow by a strong recovery 4.5 hrs. later. With Phaseol photosynthesis declined steeply after the initial crease and this was paralleled by a decline respiration. It is felt that the initial photosynthe decrease resulted from temporary stomatal ope ing due to decreased water uptake in Phaseolus. contrast, the halophyte was able to maintain re tive stability through some unknown mechanism. does possess salt glands, which may have facilitat adjustment to the new osmotic conditions. (Case A.izona)
W71-05196

SELECTION AND MANAGEMENT OF I RIGATED PASTURE MIXTURES,
Agricultural Research Service, Denver, Colo, a Montana Agricultural Experiment Statio Bozeman. Huntley Branch; and Montana Agricu tural Experiment Station, Bozeman. Northweste Branch.
For primary bibliographic entry see Field 03F.
W71-05198

CONSUMPTIVE IRRIGATION REQUIRE MENTS FOR CROPS IN IDAHO,
Idaho Univ., Moscow. Dept. of Agricultural E gineering; and Idaho Water Resource Board.
For primary bibliographic entry see Field 03F.
W71-05201

2J. Erosion and Sedimentation

SPLASH AMOUNTS FROM WATERDROP IM PACT ON A SMOOTH SURFACE,
Agricultural Research Service, Morris, Minn. So and Water Conservation Research Div.
Calvin K. Mutchler.
Water Resources Research, Vol 7, No 1, p 195 200, February 1971. 6 p, 3 fig, 3 tab, 5 ref.

Descriptors: *Impact (Rainfall), *Hydrauli models, *Raindrops, Rainfall, Laboratory tests Velocity, Depth, Ponding, Soil erosion, Simulate rainfall, Rainfall simulators.
Identifiers: *Raindrop impact, *Splash erosion.

The mechanics of raindrop splash erosion of soi were investigated by using waterdrops impacting a terminal velocity onto various depths of water ove smooth glass. Splash weight produced by water drop impact varied with waterdrop diameter D and surface water depth d. For a smooth hard surface predicted splash in terms of waterdrop weight wa zero at d/D—0 and increased to a maximum at d/D of 0.14 and 0.20 for D—0.559 cm and 0.296 cm respectively. The influence of greater depth became relatively insignificant at a depth of about three drop diameters. (Knapp-USGS)
W71-04865

ON THE TECTONIC AND MORPHOLOGIC CLASSIFICATION OF COASTS,
Scripps Institution of Oceanography, La Jolla, Calif.
D. C. Inman, and C. E. Nordstrom.
Journal of Geology, Vol 79, No 1, p 1-21, January 1971. 21 p, 5 fig, 8 tab, 37 ref.

escriptors: *Coasts, *Geomorphology, *Geology, Classification, Geologic control, Structural geolo-, Land forming, Marine geology, Topography, rosion, Sedimentation.
entifiers: Tectonics.

terms of the gross first-order effects of plate tec-nics, there appear to be three major classes of asts and several subclasses, depending upon their sition relative to the moving plates of the tecto-here: (1) collision coasts, that is, those on the llision edge of continents and island arcs; (2) iling-edge coasts, that is, those on the trailing ge or noncollision side of a continent; and, (3) rginal sea coasts protected by island arcs. The iling-edge coasts range in form from the tectoni-ly new coasts facing beginning separation cen-s to the morphologically active coasts bordering e debris plains formed from the erosion products the continents. The good coherence between tain morphologic and tectonic features of coasts s used as a guide in formulating a purely rphologic classification with tectonic implica-ns. The morphologic classification is defined ply in terms of the width of the continental shelf d the relief of the adjacent land forms: (1) moun-nous coasts; (2) narrow-shelf hilly, and plains sts; and (3) wide-shelf hilly, and plains coasts. napp-USGS)
1-04869

SIMULATION MODEL OF A COMPLEX CURVED SPIT,
ttingham Univ. (England). Dept. of Geography.
chlaine A. M. King, and M. F. McCullagh.
rnal of Geology, Vol 79, No 1, p 22-37, January 1. 6 p, 8 fig, 2 tab, 3 ref.

scriptors: *Simulation analysis, *Sand spits, nd bars, *Mathematical models, Littoral drift, als, Waves (Water), Winds, Currents (Water), morphology, Surf, Shores, Computer pro-ms.
ntifiers: Hurst Castle spit (England).

imulation model of a coastal spit is presented to strate the value of such models in studying the cesses that lead to spit formation. Hurst Castle in Hampshire, England was chosen for the del because it has a distinctive form due to the ration of several easily identified wave types. e main ridge, which is composed of shingle, is gthened by westerly waves, while storm waves d it up. The recurves are formed of material ted round the end of the main ridge by waves n the south. Waves from the northeast, coming vn the Solent, build the lateral recurves. These ome longer and more numerous toward the al end of the spit. The computer program simu-s the operation of waves from the west, storm es, southeasterly waves, and waves from the theast. In addition, a depth factor simulates the easing depth of water offshore. This accounts the increase in number of recurves toward the al end. A refraction factor allows the curvature he main ridge to be simulated. The proportion andom numbers allocated to these variables can djusted in the data input to elucidate the part play in the formation of the spit. The close fit he standard spit to the real spit suggests that the trolling variables are being correctly simulated. app-USGS)
1-04870

AY MINERALS IN CALICHE DEPOSITS OF STERN NEW MEXICO,
vard Univ., Cambridge, Mass. Dept. of Geolog-Sciences.
primary bibliographic entry see Field 02G.
1-04871

E MULTIPLE CAUSALITY OF BARRIER ANDS,
stern Washington State Coll., Bellingham. Dept. eology.
rice L. Schwartz.
Journal of Geology, Vol 79, No 1, p 91-94, January 1971. 4 p, 3 fig, 13 ref.

Descriptors: *Sand spits, *Sand bars, *Sedimentation, Sedimentary structures, Coast, Beaches, Deposition (Sediments), Sediment transport, Waves (Water), Geomorphology, Littoral drift, Winds, Currents (Water), Surf, Shores.
Identifiers: Barrier islands.

There is wide disparity in the current literature concerning the origin of barrier islands. The acceptance of multiple causality is advocated here, and a new classification is proposed. Three basically different explanations of the formation of barrier islands are proposed: (1) upbuilding of offshore bars; (2) cutting of inlets through spits; and (3) submergence of ridgelike coastal features. It is feasible that any of these causes, proceeding independently or in concert, can form barrier islands. (Knapp-USGS)
W71-04872

GLASSY OBJECTS IN TERTIARY DEEP-SEA CLAYS CORED BY THE DEEP SEA DRILLING PROJECT,
Scripps Institution of Oceanography, La Jolla, Calif.
C. C. Von Der Borch.
Marine Geology, Vol 10, No 1, p 5-14, January 1971. 10 p, 4 fig, 3 tab, 13 ref.

Descriptors: *Bottom sediments, *Pacific Ocean, *Mineralogy, *Igneous rocks, Clays, Cores, Volcanoes, Petrology, Sedimentation.
Identifiers: *Glass (Volcanic).

Small glassy spheres, ellipsoids, teardrops, cylinders and dumbbells occur in large numbers in Tertiary deep sea clays cored in the northeastern Pacific by the Deep Sea Drilling Project. These objects morphologically resemble microtektites, but have the composition of an oceanic tholeiite. On the basis of their composition and stratigraphic relationship it is considered that they are of volcanic origin and most likely have been formed in deep water by submarine volcanic processes. (Knapp-USGS)
W71-04874

MINERALOGY AND DIAGENESIS OF SOME SOUTH AFRICAN COASTAL AND MARINE CARBONATES,
Cape Town Univ., South Africa. Dept. of Geology.
W. G. Siesser.
Marine Geology, Vol 10, No 1, p 15-38, January 1971. 24 p, 6 fig, 3 tab, 23 ref.

Descriptors: *Beaches, *Bottom sediments, *Calcite, *Diagenesis, Carbonates, Magnesium carbonates, Mineralogy, Ion exchange, Distribution patterns, Dunes, Sands, Geochemistry.
Identifiers: *Aragonite, South Africa.

The dominant carbonate minerals in South African dune, beach, coastal bay, continental shelf, and upper slope environments are aragonite and low-magnesian calcite. In the area studied, there is little difference between the carbonate mineralogy of the beaches and dunes, but the beach-dune environment contains considerably more aragonite and less low-magnesian calcite than the marine environment. Mean high-magnesian calcite values are strikingly uniform for all environments, differing less than 1% between the marine and beach-dune environments. High-magnesian calcite, which is considered the most sensitive mineral to diagenetic changes, shows no mineralogic alteration in the beach-dune environment, but does in sediments presently in the marine environment. Diagenetic alteration of high-magnesian calcite to low-magnesian calcite occurred as a result of prolonged subaerial exposure of the continental shelf during Pleistocene sea-level fluctuations. Recent beach-dune sediments have not been sufficiently isolated from the marine environment to allow alteration of high-magnesian calcite. (Knapp-USGS)
W71-04875

SAND WAVES IN THE SOUTHERN BIGHT OF THE NORTH SEA,
Rijkswaterstaat-Deltadienst, Hague 9netherlands).
J. H. J. Terwindt.
Marine Geology, Vol 10, No 1, p 51-67, January 1971. 17 p, 8 fig, 4 tab, 11 ref.

Descriptors: *Sand waves, *Ripple marks, *Bottom sediments, *Continental shelf, Sedimentary structures, Currents (Water), Waves (Water), Storms, Sands.
Identifiers: *North Sea.

North of the Hinder Banks of the North Sea, sand waves are found, 3-15 m high, with the steep side to the south. Further to the north the steep sides of the sand waves are directed northward. There is no explanation as yet for this phenomenon. In one location it was observed that the height of the sand wave crests is related to the frequency of occurrence of heavy gales and the length of calm weather periods. The maximum observed variation in the height of the sand wave crests was about 2 m. Wandering mega-current ripples (height 0.2-2 m) were observed on the flanks of the sand waves. The crests of these current ripples often make an angle with the sand wave crests. In many locations it was observed that the travelling direction of these ripples (according to their asymmetry) is directed towards the crest of the sand wave from both sides. The grain size differs significantly from one place to another. (Knapp-USGS)
W71-04876

A CLAY MINERAL INVESTIGATION OF SIX CORES FROM THE GULF OF MEXICO,
Research Council of Alberta, Edmonton; and Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
D. W. Scafe, and G. W. Kunze.
Marine Geology, Vol 10, No 1, p 69-85, January 1971. 17 p, 8 fig, 3 tab, 21 ref.

Descriptors: *Bottom sediments, *Gulf of Mexico, *Mineralogy, *Clay minerals, Montmorillonite, Kaolinite, Illite, Sands, Silts, Quartz, Clays, Provenance, Differential thermal analysis, X-ray diffraction, Particle size, Centrifugation.
Identifiers: Chlorite, Feldspars.

Samples were studied from each color change in six gravity cores from nearshore to deep-sea areas in the Gulf of Mexico. Analytical methods and techniques used to characterize the sediments were X-ray diffraction, differential thermal analysis, cation exchange capacity, particle size distribution and fractionation of the clay-size material with the supercentrifuge. The clay minerals and semi-quantitative estimates of their abundance suggest that the sum of source conditions has remained constant during and since Pleistocene time represented by the cores in this study. Montmorillonite and kaolinite are not more abundant in warm water than in cold water sediments and illite and chlorite are not more abundant in cold water than in warm water sediments from the Gulf of Mexico. Silt and clay-size materials are approximately equal except for the cores farthest from the Mississippi Delta where clay-size material dominates. In the clay-size fraction, montmorillonite is generally more abundant than illite, while daolinite comprises less than 20% and chlorite less than 7%. Quartz and feldspar exist only in the 2-0.2 micron portion of the clay-size fraction. (Knapp-USGS)
W71-04877

COBALT AND TANTALUM TRACERS MEASURED BY ACTIVATION ANALYSIS IN SEDIMENT TRANSPORT STUDIES,
Inst. for Soil Fertility, Haren; Delft Hydraulics Lab.; and Reactor Inst., Delft, Netherlands.
For primary bibliographic entry see Field 02L.
W71-04887

GEOCHEMISTRY OF LITHIUM IN THE SEDIMENTARY CYCLE,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii; and Moscow State Univ. (USSR). Dept. of Geochemistry.
For primary bibliographic entry see Field 02K.
W71-04893

ATLANTIC CONTINENTAL SHELF AND SLOPE OF THE UNITED STATES -- GRAVELS OF THE NORTHEASTERN PART,
Geological Survey, Washington, D.C.
John Schlee, and Richard M. Pratt.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 - Price $2.00. Geological Survey Professional Paper 529-H, 1970. 39 p, 18 fig, 5 plate, 101 ref.

Descriptors: *Sediment transport, *Gravels, *Northeast U. S., *Continental shelf, *New England, Continental slope, Alluvium, Glaciers, Geomorphology, Glacial drift, Sediments, Particle size, Soil types, Rocks, Lithification, Sedimentary rocks, Sedimentology, Petrography.
Identifiers: *Gulf of Maine, Scotian Shelf, Georges Bank.

This report investigates (1) the patterns of gravel dispersal, (2) the processes of gravel deposition, and (3) the bedrock geology of the Gulf of Maine. Gravel has been deposited on the continental margin off New England (1) in the Gulf of Maine-Scotian Shelf-Georges Bank complex and (2) as scattered patches on the continental shelf south of New England and east of New Jersey. The greatest amounts and largest sizes of gravel are in the exit channels (Great South Channel and Northeast Channel) from the Gulf of Maine that flank Georges Bank. The gravel on the Scotian Shelf is intermediate between that of the Gulf of Maine and Georges Bank. Till-like sediment is near better sorted gravelly sand. Pebble roundness is variable. Pebbles are granitic south of Nova Scotia but are mixed with schist and gneiss. Schist and gneiss are more prevalent southwest of Nova Scotia. (Woodward-USGS)
W71-04969

CLAY MOBILITY IN LANDSLIDES, VENTURA, CALIFORNIA,
Columbia Univ., New York. Dept. of Geology; and Getty Oil Co., Ventura, Calif. , Dept. of Engineering.
Paul F. Kerr, Robert A. Stroud, and Isabella M. Drew.
American Association of Petroleum Geologists Bulletin, Vol 55, No 2, p 267-291, February 1971. 25 p, 24 fig, 4 tab, 15 ref.

Descriptors: *Landslides, *Clay, *California, Soils, Mass wasting, Creep, Movement, Mudflows, Soil erosion, Soil conservation, Groundwater movement, Soil mechanics, Drainage programs, Infiltration.
Identifiers: *Ventura oil field (Calif), *Landslide control.

Landslides cover about 345 acres, or 45% of the eastern producing area of the Ventura Avenue oil field, California. By the end of 1969, 61 oil wells were destroyed by landslide activity. A major slide in January 1968 involved more than 1 million cu yd of material and traveled 100 ft within a few minutes. In general, however, slides have been controlled and movement has been slow. The landslides occur mostly in massive granular sandstones of the middle Pico Formation (Pliocene) which are intercalated at irregular intervals with clay-bearing strata. The sandstone is a granular and poorly cemented subangular, porous arkose. Clay strata are ordinarily thin but contain substantial amounts of montmorillonite with some illite and a minor content of kaolinite. The clay-water mixture probably is the most important factor in landslide mobility at Ventura, although slope, structure, and compaction require proper consideration. For the most part, control of moisture has proved to be the most rewarding measure. (Knapp-USGS)
W71-05047

ANALYSIS OF SCALLOP PATTERNS BY SIMULATION UNDER CONTROLLED CONDITIONS,
University of Western Ontario, London. Dept. of Geography, and McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M. F. Goodchild, and D. C. Ford.
Journal of Geology, Vol 79, No 1, p 52-62, January 1971. 11 p, 5 fig, 3 tab, 14 ref.

Descriptors: *Erosion, *Karst, *Limestones, *Caves, Ripple marks, Subsurface drainage, Carbonate rocks, Weathering, Water chemistry.
Identifiers: Erosion (Solution), Scallop patterns (Erosion).

Working with plaster of paris in an experimental flume, the formation of scallop patterns, a feature of eroded limestone, was simulated under controlled conditions of velocity and viscosity. Analysis of the resulting scallop lengths as a frequency distribution shows that some of the statistical parameters are well correlated with the hydrodynamic conditions. Length is inversely related to velocity and directly to viscosity. These results are similar to those found in a theoretical dimensional analysis of the simpler flute problem. Observations in limestone caverns show that these results apply to scallops generated on limestone. (Knapp-USGS)
W71-05051

BOTTOM DRIFT FOR THE SOLITARY WAVE,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
Roland K. Price.
Journal of Geophysical Research, Vol 76, No 6, p 1600-1602, February 20, 1971. 3 p, 2 fig, 2 ref.

Descriptors: *Waves (Water), *Littoral drift, Shores, Beaches, Currents (Water), Water circulation, Sediment transport, Bed load.
Identifiers: Bottom drift (Water waves).

The drift of a fluid particle on the bottom of a channel of uniform depth (h) is calculated for the passage of a solitary wave. The magnitude of the drift for the solitary wave of maximum amplitude is 1.70 h. (Knapp-USGS)
W71-05056

TRACE ELEMENT AND ORGANIC CARBON ACCUMULATION IN THE MOST RECENT SEDIMENTS OF SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
N. F. Shimp, J. A. Schlekher, R. R. Ruch, D. B. Heck, and H. V. Leland.
Illinois Geological Survey Environmental Geology Notes, No 41, January 1971. 25 p, 18 fig, 3 tab, 5 ref.

Descriptors: *Bottom sediments, *Sediments, *Trace elements, *Carbon, *Lake Michigan, *Data collections, Sampling, Chemical analysis, Cores, Clays, Evaluation.
Identifiers: *Recent sediments, Tables of data.

Trace elements were determined in 21 grab samples and in sections of 21 cores collected from southern Lake Michigan. In all, 119 sediment samples were analyzed for 13 trace elements, organic carbon, and clay. Bromine, chromium, copper, lead, and zinc are concentrated in the uppermost, or recently deposited, portions of organic-rich, fine-grained, southern Lake Michigan sediments. High concentrations of these elements correlate more closely with the amounts of organic carbon present than with clay-size material, water depth, iron oxide, or manganese oxide. Off major river mouths, trace elements have accumulated to greater depths within the sediments in deeper regions of the lake, which is probably a result of high depositional rates associated with the river sediment load. Trace elements showing little accumulation in the recently deposited sed are beryllium, boron, cobalt, lanthanum, ganese, nickel, scandium, and van (Woodard-USGS)
W71-05064

GEOLOGY AND HYDROLOGY OF SELE PLAYAS IN WESTERN UNITED STATES.
Massachusetts Univ., Amherst. Dept. of Geo

Available from NTIS as AD-709 683 - $ paper copy, $0.95 in microfiche. Massac University, Geology Department, Final Sc Report (Part II), to Air Force Cambridge Re Laboratories (AFCRL-69-0214), May 197 p. Contract AF 19 (628)-2486.

Descriptors: *Playas, *Sedimentation, Lake Geomorphology, Deserts, Evapo Hydrogeology, Particle size, Climates, W Surface waters, Groundwater, California, N New Mexico, Utah, Oregon, Arizona, Groun movement, Discharge (Water), Groun basins.
Identifiers: *Western U.S.

About 125 playas studied in the western States can be divided into 'coarse-grained p The 'fine-grained playas' are characterized deposits of silts and clays, (2) slow artesia capillary movement of water through the s (3) mostly smooth, hard surfaces, and (4) tion of giant desiccation polygons. The 'c grained playas' are characterized by: (1) d of sand, silt, and evaporites, (2) rapid ca discharge, (3) a water table nearly at the s and (4) soft surficial sediments. On playa su capillary discharge produces puffy ground, a surface-water flooding produces smooth, ground. Capillary discharge combined with d tion of mud from floods with roots and water ported plants produces highly irregular k ground in some playas. Playas change over years because of long-term changes in the en ment and over a period of days or months be of short-term changes in the environment an a period of days or months because of shor changes in weather and precipitation. Many have grown in recent years at the expense jacent desert flats. (See also W71-05074 thru 05080) (Knapp-USGS)
W71-05073

GEOLOGY AND HYDROLOGY OF RO PLAYA AND ROSAMOND PLAYA, CALI NIA,
Massachusetts Univ., Amherst. Dept. of Ge and Mobil Oil Corp., Shreveport, La.
Ward S. Motts, and David Carpenter.
In: Geology and Hydrology of Selected Pla Western United States, Massachusetts Unive Geology Department, Final Scientific Report II) to Air Force Cambridge Research Labora (AFCRL-69-0214) Chapter 2, p 23-65, May 43 p, 25 fig, 7 ref.

Descriptors: *Playas, *Sedimentation, Lake b Geomorphology, Deserts, Evapor Hydrogeology, Particle size, Climates, Wea Surface waters, Groundwater, California, Ne New Mexico, Utah, Oregon, Arizona, Groundw movement, Discharge (Water), Groundw basins.
Identifiers: *Western U.S.

Five major playa-surface types were observe Rogers Playa and Rosamond Playa, California a surface of 'mud curls' or fragments of con upward mud polygons, (2) a smooth, hard, pact surface, (3) an irregular puffy surface higher porosity than the smooth surface, transitional surface containing areas of both smooth and the puffy surfaces, and (5) a gene smooth surface characterized by a white cru salt and carbonate. The surface types changed

year to year primarily because of surface-water floodings. Soil moisture contents of samples from test holes showed (1) a general downward increase of moisture in fine-grained sediments of the same size, (2) a decrease of moisture content where the sediments became more silty and sandy, and (3) a decrease of moisture in some clays and silts resting above sand zones. Increasing desiccation of the fine-grained deposits accompanied by the lowering of potentiometric levels has been an important factor in the continued formation of giant desiccation polygons on Rogers Playa. (See also W71-05073) (Knapp-USGS)
W71-05074

GEOLOGY AND HYDROLOGY OF COYOTE PLAYA,
Massachusetts Univ., Amherst. Dept. of Geology.
David J. Hagar.
In: Geology and Hydrology of Selected Playas in Western United States Massachusetts University, Geology Department, Final Scientific Report (Part II), to Air Force Cambridge Research Laboratories (AFCRL-69-0214) Chapter 3, p 66-107, May 1970. 42 p, 4 fig, 2 tab, 31 ref.

Descriptors: *Playas, *Sedimentation, Lake basins, Geomorphology, Deserts, Evaporation, Hydrogeology, Particle size, Climates, Weather, Surface waters, Groundwater, California, Nevada, New Mexico, Utah, Oregon, Arizona, Groundwater movement, Discharge (Water), Groundwater basins.
Identifiers: *Western U.S.

Coyote Lake, California occupies the central portion of a basin bounded on the north, west, and east sides by mountains of moderate relief and on the south side by a broad plain extending to the Mojave River. The areas surrounding the playa show evidence of a former, perennial lake. The lake sediments underlying the playa are very fine-grained and compact, and have clay contents as high as 57%. Changes of the playa surfaces result from moisture changes of the clays near the surface due to floodings of the playa. Most of the playa has a smooth, hard surface, but in some areas soft, dry, puffy surfaces occur. The extent and nature of these two surface types change with time. Although puffy surfaces commonly are associated with groundwater discharge on other playas, water from depth beneath Coyote Lake is supplying little moisture to the clays. The playa surface has giant desiccation fissures which intersect and form polygons ranging from 100 to 300 feet across. The majority are relict fissures, filled with sediment. The playa is not aggrading permanently, although material is brought to the playa during periodic flooding. The presence of loose, coarse detritus on the clay surface suggests that the fine materials are deflated. (See also W71-05073) (Knapp-USGS)
W71-05075

RESULTS OF TEST-DRILLING AND WINTER MAPPING PROGRAMS ON COYOTE PLAYA, CALIFORNIA,
Massachusetts Univ., Amherst. Dept. of Geology.
Ward S. Motts.
In: Geology and Hydrology of Selected Playas in Western United States, Massachusetts University, Geology Department, Final Scientific Report (Part II), to Air Force Cambridge Research Laboratories (AFCRL-69-0214), Chapter 3, Pt. 2, p 108-136, May 1970. 29 p, 10 fig, 7 ref.

Descriptors: *Playas, *Sedimentation, Lake basins, Geomorphology, Deserts, Evaporation, Hydrogeology, Particle size, Climates, Weather, Surface waters, Groundwater, California, Nevada, New Mexico, Utah, Oregon, Arizona, Groundwater movement, Discharge (Water), Groundwater basins.
Identifiers: *Western U.S.

In order to learn more about the sediments and the geomorphic processes operative on Coyote Playa, California, a rotary drilling and coring program was conducted in 1965 and 1966. Throughout the playa surface, capillary discharge of groundwater occurs from a shallow (10 to 25 foot) extensive zone of subsurface permeability, and capillary discharge combined with hydrostatic head occurs from deeper water-bearing beds below the playa clays. This capillary discharge may have an important influence on the surface morphology. Puffy ground and the wavy undulating surface may be formed wholly or in part from processes associated with groundwater discharge. (See also W71-05073) (Knapp-USGS)
W71-05076

RECONNAISSANCE GEOLOGY OF BIG SMOKY PLAYA, NEVADA,
Chevron Oil Co., Jackson, Miss.
Robert F. Walker, and Ward S. Motts.
In: Geology and Hydrology of Selected Playas in Western United States, Massachusetts University, Geology Department, Final Scientific Report (Part II), to Air Force Cambridge Research Laboratories (AFCRL-69-0214), Chapter 4, p 137-165, May 1970. 29 p, 13 fig, 2 tab, 13 ref.

Descriptors: *Playas, *Sedimentation, Lake basins, Geomorphology, Deserts, Evaporation, Hydrogeology, Particle size, Climates, Weather, Surface waters, Groundwater, California, Nevada, New Mexico, Utah, Oregon, Arizona, Groundwater movement, Discharge (Water), Groundwater basins.
Identifiers: *Western U.S.

Big Smoky Playa is in the southern part of Big Smoky Valley, Nevada. Well-developed shoreline encircle the playa, suggesting that the location of a Pleistocene lake (Lake Tonopah) influenced its size and shape. Surface types on Big Smoky Playa in 1965 ranged from a hard, smooth surface to a soft, puffy one. Several holes were augered beneath the transition surface, in one place to a depth of 20 feet; however, a water-bearing zone was not penetrated. No significant textural difference was found in the sediments underlying the puffy areas and the smooth hard areas. Groundwater discharge from a shallow aquifer controls the formation of puffy ground on Big Smoky Playa. The shallow aquifer consists of complex interfingering of permeable lenses of sand and coarse silt within the less permeable silt and clay. Water under hydrostatic head fills the sand-silt lenses and capillary flow from these lenses produces the puffy ground. (See also W71-05073) (Knapp-USGS)
W71-05077

GEOLOGY AND HYDROLOGY OF TROY PLAYA, SAN BERNARDINO COUNTY, CALIFORNIA,
Texas Univ., Austin. Bureau of Economic Geology.
Charles G. Groat.
In: Geology and Hydrology of Selected Playas in Western United States, Massachusetts University, Geology Department, Final Scientific Report (Part II) to Air Force Cambridge Research Laboratories (AFCRL-69-0214), Chapter 5, p 166-199, May 1970. 34 p, 13 fig.

Descriptors: *Playas, *Sedimentation, Lake basins, Geomorphology, Deserts, Evaporation, Hydrogeology, Particle size, Climates, Weather, Surface waters, Groundwater, California, Nevada, New Mexico, Utah, Oregon, Arizona, Groundwater movement, Discharge (Water), Groundwater basins.
Identifiers: *Western U.S.

Troy Playa is located in the southeast corner of the Lower Mojave Valley, an area formerly occupied by Lake Manix of late Pleistocene age. The upper 10 to 15 feet of playa sediments have two lithofacies: (1) an upper mud facies grading to sandy mud near the playa margins and (2) an underlying sand facies characterized by sand and muddy sand granular coarse sand in the upper few inches. The sand facies probably records fluvial and eolian deposition, whereas most of the mud was deposited in ephemeral playa lakes. Most of Troy Playa has a puffy surface produced by capillary discharge of shallow groundwater. A hard playa surface is present in the southwestern part of the playa where the water table is farther below the surface. Declining groundwater levels have resulted in a decrease in capillary discharge at Troy Playa which could foster a conversion from a puffy to a hard-compacted playa surface. Heavy pumpage and minimal recharge caused a decline in the potentiometric surface. The decline in areas of heavy pumpage west of the playa is resulting in intrusion of poor-quality water from the Troy Playa area into freshwater aquifers west of the playa. (See also W71-05073) (Knapp-USGS)
W71-05078

RECONNAISSANCE GEOLOGY OF CLAYTON PLAYA, NEVADA,
Shell Oil Co., Midland, Tex.
David B. Matz.
In: Geology and Hydrology of Selected Playas in Western United States, Massachusetts University, Geology Department, Final Scientific Report (Part II) to Air Force Cambridge Research Laboratories (AFCRL-69-0214), Chapter 6, p 214-236, May 1970. 23 p, 12 fig, 7 ref.

Descriptors: *Playas, *Sedimentation, Lake basins, Geomorphology, Deserts, Evaporation, Hydrogeology, Particle size, Climates, Weather, Surface waters, Groundwater, California, Nevada, New Mexico, Utah, Oregon, Arizona, Groundwater movement, Discharge (Water), Groundwater basins.
Identifiers: *Western U.S.

Clayton Valley is the terminal discharging locality for deep water circulation throughout the Tonopah area of Nevada. Logs of closely-spaced test holes show disturbed and chaotic deposits which are characteristic of many terminal groundwater discharging playas. The large amount of groundwater and capillary discharge accompanied by deposition of salts has probably disrupted the bedding and lamination of sediments formed in the playa and playa-lake environment. Also by this process, silty mine tailings have been destroyed in the last 50 years. In some places high mineralization of groundwater is related to the formation of hard and soft irregular puffy ground. Near the center of the playa small areas of knobby-hard ground are formed around the accumulation of twigs, branches and roots carried into the playa by floods. (See also W71-05073) (Knapp-USGS)
W71-05079

SOME HYDROLOGIC AND GEOLOGIC PROCESSES INFLUENCING PLAYA DEVELOPMENT IN THE WESTERN PART OF THE BASIN AND RANGE PROVINCE, UNITED STATES,
Massachusetts Univ., Amherst. Dept. of Geology.
Ward S. Motts.
In: Geology and Hydrology of Selected Playas in Western United States, Massachusetts University, Geology Department, Final Scientific Report (Part II) to Air Force Cambridge Research Laboratories (AFCRL-69-0214), Chapter 7, p 237-286, May 1970. 50 p, 28 fig, 3 tab, 13 ref.

Descriptors: *Playas, *Sedimentation, Lake basins, Geomorphology, Deserts, Evaporation, Hydrogeology, Particle size, Climates, Weather, Surface waters, Groundwater, California, Nevada, New Mexico, Utah, Oregon, Arizona, Groundwater movement, Discharge (Water), Groundwater basins.
Identifiers: *Western U.S.

Surface morphology of most coarse-grained and many fine-grained playas is related to several factors, including the rate of capillary discharge and the frequency of surface-water flooding. Puffy ground is present where the rate of capillarity is relatively high and where relatively few floodings occur. A smooth surface is present where the capil-

lary rate is low or lacking and where a relatively large number of floodings occur. During winter many playas of the Mojave Desert are frequently flooded. Water on the playa shifted and moved in response to changes in wind direction. Silts and clays near the surface became saturated with water, thereby increasing their mobility. Geomorphic features on playas constantly change in response to short-term and long-term climatic fluctuations. Daily and monthly changes in microrelief are commonly caused by playa flooding and by seasonal climatic variations. Sediments deposited in the playas of the Mojave Desert are soon removed by wind erosion. (See also W71-05073) (Knapp-USGS)
W71-05080

MORPHOLOGY OF THE SLIMS RIVER,
New York State Univ. College, Fredonia.
Robert K. Fahnestock.
In: Icefield Ranges Research Project Scientific Results, Volume 1: American Geographical Society (New York) and Arctic Institute of North America (Montreal), p 161-172, 1969. 12 p, 7 fig, 4 tab, 20 ref. NSF Grant GP-2814.

Descriptors: *Channel morphology, *Sediment transport, *Glaciers, *Alluvial channels, Sediment load, Regime, Braiding, Geomorphology.
Identifiers: *Outwash, *Slims River (Canada).

The Alaska Highway crosses the Slims River at mile 1060 where in 1965 the river was building a delta into Kluane Lake. Kaskawulsh Glacier, 14 mi. upstream, was the source of much of the debris being deposited in the valley. The surrounding countryside is covered with loess derived from the valley train. The discharge of the Slims River ranged from 0 to 20,000 cfs. In an upstream zone, 1 to 3 channels were cutting down in coarse gravel on a slope lower than that of the intermediate zone. The river was multichanneled in the intermediate zone with considerable bed load transport and some deposition. At all stages it was channel and bar dominated. About mile 1.5 in the intermediate zone, the slope was 15 ft./mi. and at relatively high flows in July 1965, 30 channels covered nearly half of the 6000-ft.-wide valley floor. In the downstream zone at high stages the river had a few bars and graded into a sheet of flowing water. On sand, at mile 6.2 in the downstream zone, on a slope of 4.5 ft./mi. 20 channels covered nearly all of the 5700-ft.-wide valley floor. The stream was regrading the valley train. In 1967, the Kaskawulsh Glacier's contribution to the Slims River shifted subglacially to the Kaskawulsh River, imposing a new set of conditions on the valley train and Kluane Lake. Initial changes due to this shift include a major decrease in discharge of Slims River and an increase in amount of blowing sediment. (Knapp-USGS)
W71-05101

ON THE MICROSCOPIC DETERMINATION OF THE VOLUME SIZE DISTRIBUTION OF FINE-GRAINED SUSPENDED PARTICLES,
Johns Hopkins Univ., Baltimore, Md., Chesapeake Bay Inst.
For primary bibliographic entry see Field 07B.
W71-05107

MINERALOGY OF A PLAYA SOIL AND UNDERLYING SEDIMENTS FROM THE HIGH PLAINS MEDIUM-TEXTURED SOIL ZONE,
Texas Tech. Univ., Lubbock. Dept. of Soil Science.
Kenneth Ray Davis.
M Sc Thesis, Texas Tech University, December 1970. 109 p, 18 fig, 13 tab, 66 ref. OWRR Project B-004-TEX (1).

Descriptors: *Playas, *Sediments, *Soil types, *Texas, Sedimentation, Recharge, Geology, Mineralogy, Clay minerals, Soil classifications, Soil formation, Soil chemistry, Soil investigations, Soil physical properties, Permeability.
Identifiers: *Playa soils.

The primary objectives of this study were (1) to determine the mineralogy of a selected playa soil and its underlying sediments and (2) to determine the relationship of the sediments to the associated upland soils. The selected playa was located on native rangeland in eastern Hockley County, Texas. A soil mapped as Randall clay occupies the floor of the playa which seemed to be typical of the medium-textured soil zone. Appreciable natural recharge of playa water to the aquifer is unlikely because of the high amount of fine expanding clay in the playa soil. (Knapp-USGS)
W71-05112

THE ESTABLISHMENT OF VEGETATION ON NONTOPSOILED HIGHWAY SLOPES IN WASHINGTON,
Washington State Univ., Pullman. Agricultural Research Center.
For primary bibliographic entry see Field 04D.
W71-05147

2K. Chemical Processes

NUTRIENTS IN STREAMS DRAINING WOODLAND AND FARMLAND NEAR COSHOCTON, OHIO,
Agricultural Research Service, Beltsville, Md. Soils Lab.
For primary bibliographic entry see Field 05B.
W71-04856

STABLE CARBON ISOTOPES IN BLUE-GREEN ALGAL MATS,
Texas Univ., Port Aransas. Inst. of Marine Science; and Texas Univ., Port Aransas. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02L.
W71-04873

RADON IN GROUNDWATERS OF DOLOMITIC AND CALCAREOUS AQUIFER IN APULIA (SOUTHERN ITALY),
CNEN, Laboratory for the Application of Radioisotopes to Hydrogeology, Bari, and Bari Univ., Italy.
G. Magri, and G. S. Tazioli.
In: Isotopes Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Engergy Agency STI/PUB/255, Paper No SM-129/53, p 835-845, 1970. 11 p, 6 fig, 12 ref.

Descriptors: *Radioisotopes, *Tracers, *Hydrogeology, *Karst, Aquifers, Limestones, Dolomites, Saline water intrusion, Groundwater movement, Water circulation, Water chemistry, Water wells, Springs, Sampling, Water analysis, On-site tests.
Identifiers: *Radon, *Italy.

The Mesozoic limestones and dolomites forming the basement of the whole of Apulia, Italy are a huge natural groundwater reservoir with fresh water overlying intruding sea water. The radon content of these waters was determined by in-situ measurements of gamma activity of the decay products of radon, which was collected on activated carbon by filtering the water. Measurements were made on water from springs and from drilled and hand-dug wells in areas where the geological conditions are known. Where there are rock levels in which the radioactivity is higher than that normally encountered in the aquifer, the radon provides a natural tracer for following groundwater circulation. The radon contents are studied in relation to the water temperature and salinity, the natural gamma radioactivity of the rocks, carbon dioxide contents, and the filtration rate, using radioactive tracers and the borehole dilution technique. Where the natural radioactivity of the rocks is distributed evenly, a relationship was observed between the mobility of the groundwater and the radon content: in general, the greater the mobility the higher the radon content. (Knapp-USGS)
W71-04884

SILICON-32 HYDROLOGY,
Tata Inst. of Fundamental Research, Bombay, India.
D. Lal, V. N. Nijampurkar, and S. Rama.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/54, p 847-868, 1970. 22 p, 5 fig, 5 tab, 26 ref.

Descriptors: *Radioactive dating, *Carbon radioisotopes, *Groundwater, *Hydrogeology, *Surface waters, Precipitation (Atmospheric), Mixing, Groundwater movement, Streamflow, Aquifers, Soil water.
Identifiers: *Silicon radioisotopes, *Groundwater dating.

Extensive studies of cosmogenic Si-32 activity in precipitation surface and sub-surface waters, rain water, and rock/soil systems have established its usefulness for (1) dating groundwater younger than 2000 years and (2) checking the validity of C-14 ages between 2000 and 5000 years. If a concordant age is found based on both Si-32 and C-14 the deduced apparent age (irrespective of the mode used) is in fact close to the 'true age' of the ground water. However, if this is not so, it would be expected that a given water body will look younger on the basis of a shorter-lived radioisotope and that the 'true age' would be even greater than that obtained on the basis of the longer-lived isotope. Such a situation would result from mixing of old and young waters in the aquifer. Intercomparison of Si-32 and C-14 ages is valuable in the delineation of groundwater characteristics. (Knapp-USGS)
W71-04885

GEOCHEMISTRY OF LITHIUM IN THE SEDIMENTARY CYCLE,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii; and Moscow State Univ. (USSR). Dept. of Geochemistry.
A. B. Ronov, A. A. Migdisov, N. T. Voskresenskaya, and G. A. Korzina.
Translated from Geokhimiya, No 2, p 131-161, 1970. Geochemistry International, Vol 7, No 1, p 75-102, 1970. 28 p, 9 fig, 6 tab, 44 ref.

Descriptors: *Geochemistry, *Sedimentation, *Weathering, *Alkali metals, Distribution patterns, Trace elements, Leaching, Geology, Mineralogy, Sediment transport, Clays, Clay minerals.
Identifiers: *Lithium, USSR.

A large amount of data is surveyed to reveal the pattern of the geochemistry of lithium during weathering and deposition. This survey extends from the Riphean to the Quaternary in the Russian platform. Elution of Li predominates in the initial (alkaline) stage of weathering, while in the later (more acid) stages, the Li accumulates with Al in clay minerals. There are two main types of Li distribution in sedimentation. The first involves proportional deposition with Al in the aluminosilicate structures of clay minerals; it is the commoner during sedimentation and preserves the relations built up in the weathering crust. The second (rarer) type of Li distribution occurs in the sediments of salt lakes, where the Li accumulates along with Mg, SO3, and Cl, which are characteristic of sea water. The Li balance in the crust is discussed, and it is concluded that there is no substantial disturbance in the balance in the outer parts of the Earth. The bulk of the Li is concentrated in rocks of the continental crust. (Knapp-USGS)
W71-04893

DISTRIBUTION AND MIGRATION OF LEAD IN GROUND WATERS,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).

rimary bibliographic entry see Field 05B.
-04894

GEOCHEMICAL INVESTIGATIONS IN RUDNYY ALTAY,
emiya Nauk SSSR, Moscow. Institut Geok-
i Analiticheskoi Khimii.
Malynga, and A. D. Ayvazyan.
lated from Geokhimiya, No 3, p 364-371,
Geochemistry International, Vol 7, No 2, p
76, 1970. 8 p, 4 tab, 11 ref.

iptors: *Geochemistry, *Trace elements,
*Sulfates, *Surveys, Exploration, Soil water,
ation effects, Bioindicators, Mining.
fiers: *Biogeochemistry, *Ore deposits,
R.

with different conditions of migration of
cal elements have been outlined in the forest
teppe zones of the Rudnyy Altay, USSR.
emically anomalous landscapes are distin-
d by relatively low pH of soil water and high
t of SO4, Fe, and trace elements such as
copper, zinc, molybdenum, and silver in soil
lants. The ratio of biological absorption is
and ash content of plants higher over ore
ts than outside their boundaries. Plants over
posits are stunted and afflicted with chloro-
nts of the pink family flourish in areas with
r mineralization. These characteristics have
used in biogeochemical prospecting in the
y Altay. (Knapp-USGS)
04895

HEMICAL TRENDS IN THE OCCUR-E AND MIGRATION FORMS OF GOLD TURAL WATER,
ion Scientific Research Inst. of Hydrogeolo-
Engineering Geology, Moscow (USSR).
Goleva, V. A. Krivenkov, and Z. G. Gutz.
ated from Geokhimiya, No 6, p 744-757,
Geochemistry International, Vol 7, No 3, p
9, 1970. 12 p, 5 fig, 6 tab, 15 ref.

ptors: *Water chemistry, *Gold, *Solutes,
ransport, Geochemistry, Inorganic com-
, Organic compounds, Sampling, Hydrogen
centration, Oxidation-reduction potential.
iers: USSR.

udies and calculations show that pH and Eh
he content and form of transport of gold in
waters. Transport as chlorides is possible
rarely encountered strongly acid HCl waters
ss than 1, Eh greater than 0.8V). Weakly
d alkaline aureole waters of sulfide deposits
eater than 6.5, Eh less than 0.5 V) in the
e of thiosulfates give rise to the very stable
O3)2 (3-). Gold forms not only inorganic
nds but also organic ones. Groundwaters
he surface or small depths in gold-ore
s with high filtration rates transport gold
in colloidal and finely divided forms. (K-
SGS)
896

FFECT OF SELECTED HYDROLOGIC BLES ON STREAM SALINITY,
tural Research Service, Chickasha, Okla.
Water Conservation Research Div.
nary bibliographic entry see Field 02A.
897

NTRIBUTION TO THE ECOLOGY OF RIA IN RUNNING WATERS. OBSERVA-MADE IN THE LANGUEDOC ERRANEAN AREA; A STUDY OF THE NIC ACID FACTOR, (IN FRENCH),
llier Univ. (France). Lab. of Zoology.
lause.
abstract. Bulletin de la Societe Zoologique
ce, Vol 94, No 2, p 223-228, 1969.

tors: *Animal physiology, *Carbon dioxide,
, Ecology, Tubificids, Metabolism.
rs: Carbonic gradient, Planaria.

This summary of a thesis is concerned with the influence of carbon dioxide on life activity of stream-inhabiting Planariidae: Dugesia gonocephala, D subtentaculata, D tigrina, and Polycellis felina. The well-being of these turbellarian worms is influenced by the dissolved carbon dioxide as much as it is by temperature and water oxygenation. The carbon dioxide is believed to be at the origin of chemotropism and favors the sensory-motor activity, metabolism, growth, sexual maturation, and an increased longevity. (Wilde-Wisconsin)
W71-04964

SPECIFIC CONDUCTANCE AS A MEANS OF ESTIMATING IONIC STRENGTH,
Geological Survey, Menlo Park, Calif.
Carol J. Lind.
For sale by Superintendent of Documents, US Goverment Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D272-D280, 1970. 9 p, 6 fig, 8 tab, 20 ref.

Descriptors: *Conductivity, *Electrical conductance, *Electrolytes, Aqueous solutions, Electrochemistry, Ions, Saline water, Saline water systems, Water analysis, Water properties, Water chemistry.
Identifiers: *Specific conductance-Ionic strength relations, Specific conductance, Ionic strength.

In an aqueous solution each cation-anion combination has its own characteristic curve on a plot, made on a log-log scale, of ionic strength versus conductance. If the major ionic combinations are known for a particular salt solution or natural-water source, ionic strength can be estimated from such a plot of these major cation-anion combinations. If, on the basis of previous periodic analyses, the ionic composition has only dilution as the main variable, then a characteristic plot may be made for that salt solution or natural-water source and used for future estimations of its ionic strength. (Knapp-USGS)
W71-04975

ANALYSIS OF WATER TEMPERATURE VARIATIONS IN LARGE RIVER,
Illinois State Water Survey, Peoria.
Veerasamy Kothandaraman.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 97, No SA 1, Paper 7908, p 19-31, February 1971. 13 p, 4 fig, 8 tab, 9 ref, append.

Descriptors: *Water temperature, *Fourier analysis, *Streamflow, *Variability, Illinois, Rivers, Seasonal, Statistical methods, Water quality, Cooling water, Thermal powerplants, Weather, Humidity.
Identifiers: Illinois River.

The seasonal variations in daily mean river water temperatures and daily mean dry bulb temperatures are adequately represented by harmonics with a periodicity of 1 year. Harmonics with a frequency higher than 1 cycle per yr contribute very little toward the seasonal variations. In the Illinois River nonseasonal variations in the daily mean water temperatures for any given day can be obtained, as a linear combination of the nonseasonal variations in the daily mean dry bulb temperatures, for that day and the preceding 2 days. (Knapp-USGS)
W71-05048

CARBON DIOXIDE EXCHANGE AT THE AIR-SEA INTERFACE: FLUX AUGMENTATION BY CHEMICAL REACTION,
Illinois Univ., Urbana. Dept. of Chemical Engineering.
J. A. Quinn, and N. C. Otto.
Supported in part by a grant from Office of Saline Water. Journal of Geophysical Research, Vol 76, No 6, p 1539-1549, February 20, 1971. 11 p, 3 fig, 26 ref.

Descriptors: *Carbon dioxide, *Air-water interfaces, *Sea water, *Water chemistry, Ion transport, Diffusion, Mass transfer, Hydrogen ion concentration, Hydration, Dehydration.
Identifiers: Carbon-dioxide flux.

The stagnant film model for the transport of CO2 across the air-sea interface is reexamined. By incorporating the constraint of electroneutrality, equations are derived to describe the flux of the carbon containing species within the film. The assumption of electroneutrality obviates the incorrect assumption of constant pH implicit in previous exchange calculations. Numerical results for typical ocean conditions indicate that for film thicknesses less than about 400 microns, oceanic exchange is not influenced by the hydration/dehydration reactions of dissolved carbon dioxide. However, if suitable catalysts are present in the ocean, the accelerated reactions are capable of augmenting the exchange rate by a considerable amount. The extent of this enhancement can be predicted by the model presented. (Knapp-USGS)
W71-05053

GEOLOGIC SIGNIFICANCE OF THE MINOR-ELEMENT COMPOSITION OF MARINE SALT DEPOSITS,
Geological Survey, La Jolla, Calif.
George W. Moore.
Economic Geology, Vol 66, No 1, p 187-191, January-February 1971. 5 p, 1 fig, 2 tab, 29 ref.

Descriptors: *Water chemistry, *Chemical precipitation, *Salts, *Trace elements, Sodium chloride, Evaporation, Mineralogy, Paleohydrology.
Identifiers: *Evaporites.

Detailed chemical analyses of marine halite rock ranging in age from Cambrian to Holocene are compared. If evaporite deposites reflect the geologic history of sea water, then a similar composition of rock salt of differing ages suggests that the ratio between ions in sea water has remained approximately constant since Cambrian time. Some elements, such as strontium and boron, are depleted in marine halite rock because they are deposited respectively earlier and later in the evaporation sequence. Lead is enriched a thousandfold, possibly because of heavy-metal concentration by microorganisms. (Knapp-USGS)
W71-05057

A PALEOHYDROLOGIC MODEL FOR MINERALIZATION OF THE WHITE PINE COPPER DEPOSIT, NORTHERN MICHIGAN,
Geological Survey, Beltsville, Md.
For primary bibliographic entry see Field 02H.
W71-05058

VAPOR-DOMINATED HYDROTHERMAL SYSTEMS COMPARED WITH HOT-WATER SYSTEMS,
Geological Survey, Menlo Park, Calif.
D. E. White, L. J. P. Muffler, and A. H. Truesdell.
Economic Geology, Vol 66, No 1, p 75-97, January-February 1971. 23 p, 7 fig, 6 tab, 58 ref.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Water vapor, *Hydrogeology, Groundwater movement, Mass transfer, Ion transport, Heat flow, Water temperature, Geysers, Water levels, Water table.
Identifiers: *Hydrothermal systems.

Vapor-dominated 'dry-steam' geothermal systems are uncommon and poorly understood compared with hot-water systems. Critical physical data on both types were obtained from U.S. Geological Survey research in Yellowstone Park. Vapor-dominated systems require relatively potent heat supplies and low initial permeability. After an early hot-water stage, a system becomes vapor dominated when net discharge starts to exceed recharge. Steam then boils from a declining water

table; most condenses below the surface, where its heat of vaporization can be conducted upward. Liquid water favors small pores and channels because of its high surface tension relative to that of steam. Steam is largely excluded from smaller spaces but greatly dominates the larger channels and discharge from wells. With time, permeability of water-recharge channels, initially low, becomes still lower because of deposition of carbonates and CaSo4. The 'lid' on the system consists in part of argillized rocks and CO2 saturated condensate. Local supply of pore liquid and a great stored heat of solid phases account for the physical characteristics and the high productivity of steam wells. Vapor-dominated systems provide a good mechanism for separating volatile mercury from all other metals of lower volatility. Mercury is likely to be enriched in the vapor of these systems; the zone of condensation that surrounds the uniform reservoir is attractive for precipitating HgS. (Knapp-USGS)
W71-05059

TRACE ELEMENT AND ORGANIC CARBON ACCUMULATION IN THE MOST RECENT SEDIMENTS OF SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 02J.
W71-05064

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965, PARTS 12-16.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05089

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA - VOLUME I.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05090

O-18/O-16 RATIOS IN SNOW AND ICE OF THE HUBBARD AND KASKAWULSH GLACIERS,
Calgary Univ. (Alberta). Dept. of Geology; and Calgary Univ. (Alberta). Dept. of Physics.
For primary bibliographic entry see Field 02C.
W71-05099

OCEANIC CO2 SYSTEM: AN EVALUATION OF TEN METHODS OF INVESTIGATION,
Oregon State Univ., Corvallis. Dept. of Oceanography.
P. Kilho Park.
Limnology and Oceanography, Vol 14, No 2, p 179-186, March 1969. 8 p, 3 fig, 1 tab, 20 ref. NSF Grant GA-1281; ONR Research Contract Nonr 1286 (10).

Descriptors: *Water chemistry, *Sea water, *Carbon dioxide, *Hydrogen ion concentration, Carbonates, Bicarbonates, Equilibrium, Alkalinity, Chemical potential, Water analysis, Chemical reactions, Geochemistry, Aqueous solutions, Saline water systems.
Identifiers: Sea water chemistry.

By combining two or more of the parameters pH, carbonate alkalinity, total carbon dioxide, and partial pressure of carbon dioxide, six equations can be obtained to express the concentration of carbonic acid that include molecular carbon dioxide, ten equations for bicarbonate ion, and eleven equations for carbonate ion concentrations. When the present-day analytical precision and the normal oceanic variances of the above four parameters are considered, the pH-partial pressure of carbon dioxide combination is the most promising to study the oceanic CO2 system. (Knapp-USGS)
W71-05104

COLORIMETRIC DETERMINATION OF DISSOLVED OXYGEN AT LOW CONCENTRATIONS,
Washington Univ., Seattle. Dept. of Oceanography.
William W. Broenkow, and Joel D. Cline.
Limnology and Oceanography, Vol 14, No 3, p 450-454, May 1969. 5 p, 2 fig, 3 tab, 9 ref.

Descriptors: *Dissolved oxygen analyzers, *Dissolved oxygen, *Laboratory tests, *Water analysis, Chemical analysis, Instrumentation, Chemical reactions, Water chemistry.
Identifiers: *Winkler method, *Dissolved oxygen analysis.

Oxygen concentrations can be determined colorimetrically by measuring the absorption of ultraviolet light by the triiodide ion that is produced when Winkler reagents are added to the sample. Samples are drawn into syringes to eliminate contact with the atmosphere. Reagents similar to those used in the Winkler method are injected into the syringes, and iodine is released in proportion to the dissolved oxygen originally in the sample. (Knapp-USGS)
W71-05108

SPECTROPHOTOMETRIC DETERMINATION OF HYDROGEN SULFIDE IN NATURAL WATERS,
Washington Univ., Seattle. Dept. of Oceanography.
Joel D. Cline.
Limnology and Oceanography, Vol 14, No 3, p 454-458, May 1969. 5 p, 3 fig, 3 tab, 15 ref. NSF Grant GA-644.

Descriptors: *Hydrogen sulfide, *Water analysis, *Spectrophotometry, Colorimetry, Analytical techniques, Chemical analysis, Water chemistry, Laboratory tests, Instrumentation, Chemical reactions.
Identifiers: *Hydrogen sulfide analysis.

A new spectrometric method of determining H2S is applicable to natural waters containing 1-1,000 microgram-atoms/liter sulfide-sulfur (0.03-32 ppm) and is free of salt effects and temperature dependence. Except at concentrations of less than 1 microgram-atom/liter, Beer's law is followed. The concentrations of the sulfide solutions estimated gravimetrically were always within 2% of the titrated value at the 95% confidence level. (Knapp-USGS)
W71-05109

2L. Estuaries

ON THE TECTONIC AND MORPHOLOGIC CLASSIFICATION OF COASTS,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02J.
W71-04869

A SIMULATION MODEL OF A COMPLEX RECURVED SPIT,
Nottingham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W71-04870

THE MULTIPLE CAUSALITY OF BARRIER ISLANDS,
Western Washington State Coll., Bellingham. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-04872

STABLE CARBON ISOTOPES IN BLUE-GREEN ALGAL MATS,
Texas Univ., Port Aransas. Inst. of Marine Science; and Texas Univ., Port Aransas. Dept. of Geological Sciences.
E. W. Behrens, and S. A. Frishman.
Journal of Geology, Vol 79, No 1, p 94-100 ry 1971. 7 p, 3 fig, 15 ref. NSF Grant GA 91

Descriptors: *Algae, *Stable isotopes, *(*Anaerobic bacteria, *Texas, Biodegr Tracers, Lagoons, Cyanophyta.
Identifiers: Baffin Bay (Tex).

Blue-green algal mats have accumulated f 1,000 years in Kleberg Point Lagoon on the of Baffin Bay, Texas. Organic carbon pr within the mats is isotopically heavier than bon associated with bay sediments. The dif between bay and mat organic carbon is pr in the older, buried sediments, and seems t creased by fractionation associated with an bacterial decomposition of algal mat matter. (Knapp-USGS)
W71-04873

GLASSY OBJECTS IN TERTIARY DE CLAYS CORED BY THE DEEP SEA DR PROJECT,
Scripps Institution of Oceanography, La Calif.
For primary bibliographic entry see Field 02
W71-04874

MINERALOGY AND DIAGENESIS OF SOUTH AFRICAN COASTAL AND M CARBONATES,
Cape Town Univ., South Africa. Dept. of Ge
For primary bibliographic entry see Field 02
W71-04875

SAND WAVES IN THE SOUTHERN BIG THE NORTH SEA,
Rijkswaterstaat-Deltadienst, Hague 9nether
For primary bibliographic entry see Field 02
W71-04876

A CLAY MINERAL INVESTIGATION C CORES FROM THE GULF OF MEXICO,
Research Council of Alberta, Edmonto
Texas A and M Univ., College Station. Dept and Crop Sciences.
For primary bibliographic entry see Field 02
W71-04877

USE OF RARE-EARTH ELEMENT TRACERS IN ESTUARIES,
Stanford Univ., Calif.
P. Kruger, and J. K. Channell.
Supported by U S Public Health Servi
Isotope Hydrology, 1970, Proceedings Sym of International Atomic Energy Agenc UNESCO, Vienna, March 9-13, 1970: Vier ternational Atomic Energy Agency STI/PU Paper No SM-129/56, p 869-883, 1970. 15 3 tab, 9 ref.

Descriptors: *Tracers, *Trace elements, * isotopes, *Neutron activation analysis, T techniques, Dispersion, Streamflow, Dis measurement, Sampling.
Identifiers: *Rare-earth elements.

For large hydrology systems, such as estuari method of stable-isotope tracing with pos pling activation analysis shows much promi method retains the inherent sensitivity of ra measurement without the concomitant ch problems of dyes and radiation proble radioisotope tracers. The rare-earth elemen sess favorable nuclear, chemical, physical, a natural abundance properties which make suitable as a tracer for flow and dispersion in estuaries. Post-sample treatment of irradia a 10-kW nuclear reactor, radiochemical separation, and gamma-ray spectroscopy yie tection limits of 1 ng for europium and 20 lanthanum. Its use has been tested in the San cisco Bay in which the background concen of lanthanum is 180 ng/l and of europium a

1. The method can be used for tracing hydraulic w or for persistence studies of suspended solids settleable solid components in the estuary. The thod competes favorably in cost, especially as scale of the system increases. As many as six e-earth elements can be measured simultane-ly. They can be used in conjunction with ioactive rare-earth elements to extend tracing e or dilution range when the total amount of iotracer is limited. (Knapp-USGS)
1-04886

BALT AND TANTALUM TRACERS MEA-RED BY ACTIVATION ANALYSIS IN SEDI-NT TRANSPORT STUDIES,
for Soil Fertility, Haren; Delft Hydraulics ; and Reactor Inst., Delft, Netherlands.
de Groot, E. Allersma, M. de Briun, and J. P. Houtman.
Isotope Hydrology, 1970, Proceedings Symposi- of International Atomic Energy Agency and ESCO, Vienna, March 9-13, 1970: Vienna, In-ational Atomic Energy Agency STI/PUB/255, er No SM-129/57, p 885-898, 1970. 14 p, 7 fig, b, 3 ref.

criptors: *Tracers, *Neutron activation analy- *Cobalt, *Suspended load, *Estuaries, Trace nents, Silts, Clays, Tracking techniques, Disper- Streamflow, Discharge measurement, pling.
tifiers: *Tantalum.

origin and transport of fine-grained sediments onnection with siltation problems of harbors navigation channels was studied using Co and tracers and activation analysis. An element ch does not occur in the sediment is fixed in the . At specified points throughout the water se sediment samples are taken to determine marking element by activation analysis. The ction and successful application of tracers that be measured by activation analysis depends on sensitivity of detection, the natural occurrence e relevant elements in the sediments under in-gation, and the fixation capacity of the tracer e various grain size fractions. Further, the in-nce of the added element on the sedimentation avior of the mud in suspension and on the rption properties must be considered. The fix-n process of Co is restricted to sediments with ial characteristics; Ta, however, can adhere ly to any sediment. Tantalum also has the ad-age that its natural content in sediments is very Large quantities (several percent by weight) adhere to the sediment without changing the mentation properties to an appreciable extent. lly any losses occur during leaching experi-ts simulating natural conditions. A detailed ment is given of the chemical aspects of the od, including the behavior of the elements in the light of the general environmental esses of sediment constituents in deltaic ms. (Knapp-USGS)
-04887

ECONNAISSANCE OF THE SANTEE RIVER UARY, SOUTH CAROLINA,
ogical Survey, Columbia, S.C.
ay Cummings.
h Carolina Water Resources Commission Re- No 2, 1970. 96 p, 28 fig, 3 plate, 16 tab, 16 ref.

riptors: *Estuaries, *South Carolina, *Stream- *Water quality, Water resources, Hydrologic Data collections, Water resources develop-, Water management (Applied), Discharge ter), Tides, Tidal effects, Density stratification, ity.
ifiers: *Santee River Estuary (SC).

chemical and physical characteristics of water e Santee River estuary were studied in relation lal conditions and fresh-water inflow, and the bility of water for use at different locations was rmined as a basis for evaluating some of the ef- of a proposed diversion of water from Lake Moultrie to the Santee River. Under normal conditions, releases of water from Lake Marion to the Santee River estuary are 500 to 600 cfs. On several days during April and May 1969, however, flood releases exceeded 40,000 cfs. A tidal discharge measurement made at mile 5.9 on the North Santee River showed a maximum flow of 18,500 cfs on the ebb tide, and a maximum flow of 18,500 cfs on the flood tide. At mile 7.0 on the South Santee River, a tidal discharge measurement showed a maximum flow of 14,500 cfs on the flood tide; on the ebb tide the maximum flow was estimated to be 15,800 cfs. Under flood conditions in April and May 1969, the Santee River estuary changed from a partially mixed to a highly stratified condition. As flood waters flushed salt water seaward, freshwater was observed below mile 5.0 on both the North and South Santee Rivers. Dissolved oxygen measurements, temperature measurements, and chemical analyses of water indicate that the quality of the water and the variations in quality are due to natural processes; only the occurrence of detergents and pesticides indicate cultural activity. Water of the North and South Santee Rivers at mile 14 and above is of excellent quality for most domestic, industrial, and agricultural uses. (Knapp-USGS)
W71-04908

PASSIVE MICROWAVE MEASUREMENTS OF SNOW, SOILS, AND OCEANOGRAPHIC PHENOMENA,
Aerojet-General Corp., El Monte, Calif. Space Div.
For primary bibliographic entry see Field 07B.
W71-04942

ON THE SEASONAL DISTRIBUTIONS OF TEMPERATURE AND SALINITY IN RHODE ISLAND SOUND,
Naval Underwater Systems Center, Newport, R.I.
David H. Shonting, and Gerald S. Cook.
Available from NTIS as AD-715 203, $3.00 in paper copy, $0.95 in microfiche. Reprinted from Limnology and Oceanography, Vol 15, No 1, p 100-112, Jan 1970. Rept No NUSC-TD-125, 15 Oct, 1970. 16 p, 9 fig, 1 tab, 11 refs.
Identifiers: *Oceanographic data, Temperature, *Sea water, Salinity, Hydrographic surveying, Thermoclines, Narragansett Bay, Rhode Island, Rhode Island Sound.

The temperature and salinity of Rhode Island Sound were measured between July 1963 and July 1964. A seasonal thermocline developed at mid-depth in spring and intensified through August. Early fall cooling and wind mixing rapidly destroyed the thermocline, rendering the water column practically isothermal by late October. The salinity patterns are more complex than those of temperature and are strongly influenced by seasonal variations in coastal runoff. Brackish water outflow from Narragansett Bay was traced as a salinity wedge as far as 20-30 km from the coast. The seasonal variation in thermal energy of the sound is estimated to be at least four orders of magnitude greater than the potential energy changes.
W71-04944

PARTICULATE ORGANIC MATTER IN KANEOHE BAY, OAHU, HAWAII,
Hawaii Inst. of Geophysics, Honolulu.
Frances Anne Steinhilper.
Available from NTIS as PB-195 806, $3.00 in paper copy, $0.95 in microfiche. Hawaii Institute of Geophysics Report HIG-70-24, Dec 1970. 53 p, 11 fig, 14 tab, 25 ref.
Identifiers: *Sea water, Organic compounds, *Bays Topographic features, Hawaii, *Organic wastes, Sea water, Carbon, Nitrogen, Particles, Carbonates, Sewage, Water analysis, Chlorophylls, Primary biological productivity, Phytoplankton, Theses, Kaneohe Bay, Oahu Island, Carbon budget.

During the 3-month period from March through May 1970, a study of particulate organic matter was undertaken in Kaneohe Bay. The Bay was divided into two basins on the basis of circulation and topography and eight stations along the length of the Bay were sampled at 5-meter intervals. Particulate organic carbon concentrations varied temporally, ranging at the sewer outfall from a high of 686 microgram/l to a low of 121 microgram/l. Concentrations were constant with depth and decreased with increasing distance from the sewer outfall. Particulate nitrogen displayed the same trends as particulate organic carbon, ranging in concentration from 117 microgram/l to 27 microgram/l at the outfall. Total organic carbon concentrations showed similar trends, decreasing from 1.6 to 0.7 microgram C/l, except at Station 2. At Station 2, high surface productivity, probably caused by increased dissolved organic concentrations, resulted in a total organic carbon concentration of 2.6 microgram/l. A carbon budget was calculated for the southern basin. Circulation and primary production were determined to be important factors in the high organic carbon concentrations in the Bay; sewage discharge and runoff were secondary sources. Sewage discharge is indirectly an important source of Bay carbon as the effluent's high nutrient content results in high productivity.
W71-04949

RESEARCH IN THE COASTAL AND OCEANIC ENVIRONMENT,
Delaware Univ., Newark.
William S. Gaither.
Available from NTIS as AD-714 853, $3.00 in paper copy, $0.95 in microfiche. Annual Status Report CMS-3M DO 28, Oct 1970. 18 p, 14 fig, 2 tab, 3 ref. ONR NR 388-096.
Identifiers: *Ocean waves, Beaches, *Seacoast, Protection, Transport properties, Deposits, Sedimentation, Continental shelves, Tides, Sensors, Damage, Structures, Erosion, Soils, Stabilization, Breakwaters, Tables, Deleware, New Jersey, Maryland, Beach erosion, Shore protection, Coastal engineering, Air water interactions, Remote sensing.

Progress during the first year of a multidisciplinary study of the coastal environment of a section of the Atlantic Sea Coast (Delaware and adjacent New Jersey and Maryland areas) is summarized. Included are field, laboratory, and theoretical investigations of sedimentary processes, coastal vegetation, tidal marsh soils, wave action and attenuation, air-sea interactions, geological history and marine biology. Correlation of ground observations with high altitude photographic imagery to provide a useful method for the remote characterization of such coastal regions is an important objective.
W71-04950

PRIORITY PROBLEMS AND DATA NEEDS IN COASTAL ZONE OCEANOGRAPHY. EARTH OBSERVATION SATELLITE PLANNING,
Virginia Inst. of Marine Science, Gloucester Point.
R. J. Byrne, J. L. Dupuy, E. J. Joseph, J. C. Mundy, Jr., and J. A. Musick.
Available from NTIS as N70 40772, $3.00 in paper copy, $0.95 in microfiche. NASA-CR-111779, Sept 70. 138 p. NASA Contract NASI-9461.
Identifiers: *Coastal ecology, *Earth resources technology satellites, *Mission planning, *Oceanography, Experimental design, Priorities, Remote sensors, Satellite observation.

Coastal zone oceanographic problems and data needs have been defined for an oceanographic satellite. Problems are based on national and coastal zone priorities. Descriptions of the problems discuss the data needs and the expected utility of remote measurement. Data needs and resolution requirements are specified for surface and satellite measurement. Remote measurables are numerically ranked and evaluated. An experiment in coastal zone oceanography is proposed for Earth Resources Technology Satellite (ERTS A). Coordination of the ERTS program with International Decade of Ocean Exploration (IDOE) is discussed.
W71-04952

SOME PECULIAR FEATURES OF THE HYDROCHEMICAL REGIME AND THE FAUNA OF MESOHALINE WATERS,
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.
V. V. Khlebovich.
Marine Biology, Vol 2, No 1, p 47-49, 1968. 5 fig, 21 ref.

Descriptors: *Saline water-freshwater interfaces, *Mixing, *Sea water, Brackish water, Fresh water, Water chemistry, Salinity, Marine animals, Biological communities, Ecotypes, Water chemistry.
Identifiers: *Mesohaline waters, Oligohaline animals.

A close connection was observed between hydrochemistry of a mixture of marine water and fresh water and the existence of an eco-physiological barrier. This barrier with salinity between 0.5 and 0.8% serves as the division line between marine and fresh water fauna. (Wilde-Wisconsin)
W71-04959

ON THE NUTRITION AND METABOLISM OF ZOOPLANKTON. VII. SEASONAL SURVEY OF NITROGEN AND PHOSPHORUS EXCRETION BY CALANUS IN THE CLYDE SEA-AREA,
Marine Biological Association of the United Kingdom, Plymouth (England). Lab.; and Marine Biological Station, Millport (Scotland).
For primary bibliographic entry see Field 02I.
W71-04965

PRIMARY PRODUCTION MEASUREMENTS ON A NATURAL PLANKTON BLOOM,
Bedford Inst., Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 02I.
W71-04967

STATUS OF SALT-WATER ENCROACHMENT IN 1969 IN SOUTHERN NASSAU AND SOUTHEASTERN QUEENS COUNTIES, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
Philip Cohen, and G. E. Kimmel.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D281-D286, 1970. 6 p, 2 fig, 4 tab, 13 ref.

Descriptors: *Saline water intrusion, *Aquifers, *New York, Withdrawal, Path of pollutants, Water balance, Sea water, Water levels, Hydrogeology, Hydrologic data, Data collections, Monitoring, Water quality.
Identifiers: *Long Island (NY).

Chloride data obtained from 'outpost' wells and other wells in southern Nassau and southeastern Queens Counties, Long Island, N.Y., indicate that landward movement of a deep wedge of salty groundwater in the area has been minimal from 1960 to 1969. Significant changes in chloride content were noted in only 3 of 30 outpost wells. Chloride content of water from a well in southeastern Queens County increased from 34 mg/l in 1960 to 112 mg/l in 1969, as a result of intensive groundwater withdrawals in that county; chloride content in two wells in Nassau County increased from 8,520 to 11,000 mg/l and from 2,000 to 8,110 mg/l during the same period. These increases resulted from local heavy pumping near the zone of diffusion. No increase in chloride content was noted in water from the Lloyd aquifer, except where leaky casings permitted downward flow of salty water. (Knapp-USGS)
W71-04976

WATER MASSES AND GENERAL CIRCULATION OF THE GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
Worth D. Nowlin, Jr.
Oceanology, Vol 6, No 2, p 28-33, February, 1971. 6 p, 15 fig.

Descriptors: *Water circulation, *Gulf of Mexico, *Thermal stratification, Currents (Water), Dissolved oxygen, Salinity, Oceanography, Water temperature.
Identifiers: Water masses.

It is possible to distinguish and identify the origins of vertically layered waters within the Gulf: the surface mixed layer, North American deep water, subtropical underwater, oxygen minimum water, Antarctic intermediate water, North American deep water, and the basin waters. A general circulation pattern consists of a clockwise Loop Current flowing from the Yucatan to the Florida Strait in the eastern Gulf, but no strong, semi-permanent currents in the western Gulf. Large current rings, or edies, form from the Loop Current. A well-defined pattern of winter flow contrasts with a highly variable summer pattern for the western Gulf. The flow is influenced greatly by bottom or lateral friction with the shelves and that the deep Gulf waters connect directly with the deep Atlantic water only through the Caribbean Sea. At depths shallower that 1,000 m, inflow to the Gulf is generally through Yucatan Strait; outflow is through the Florida Strait. (Knapp-USGS)
W71-05050

GEOLOGIC SIGNIFICANCE OF THE MINOR-ELEMENT COMPOSITION OF MARINE SALT DEPOSITS,
Geological Survey, La Jolla, Calif.
For primary bibliographic entry see Field 02K.
W71-05057

OCEANIC CO2 SYSTEM: AN EVALUATION OF TEN METHODS OF INVESTIGATION,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02K.
W71-05104

OCEANIC HEAT CONTENT OFF OREGON: ITS VARIATIONS AND THEIR CAUSES,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02E.
W71-05105

DISPOSAL OF TITANIUM DIOXIDE WASTE IN A STRATIFIED ESTUARY,
Norsk Institutt for Vannforskning, Blindern.
For primary bibliographic entry see Field 05D.
W71-05159

CAUSES OF OYSTER SPAT MORTALITY, CONDITIONS OF OYSTER SETTING BEDS, AND RECOMMENDATIONS FOR OYSTER BED MANAGEMENT,
Bureau of Commercial Fisheries, Milford, Conn. Biological Lab.
For primary bibliographic entry see Field 05C.
W71-05202

SUMMARY OF OUR PRESENT KNOWLEDGE OF THE PHYSICAL PROCESSES OF MIXING IN THE OCEAN AND COASTAL WATERS, AND A SET OF PRACTICAL GUIDELINES FOR THE APPLICATION OF EXISTING DIFFUSION EQUATIONS IN THE PREPARATION OF NUCLEAR SAFETY EVALUATIONS,
Atomic Energy Commission, Washington, D.C., AND Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Institute.
Akira Okubo, and D. W. Pritchard.
Report No NYO-3109-40, Chesapeake Bay Institute, The Johns Hopkins University, Baltimore, Maryland, Ref 69-1, September 1969. 159 p, 50 fig, 4 tab, 80 ref. USAEC Contract No. AT (30-1)3109.

Descriptors: *Mathematical models, Equ
Application methods, *Mixing, *Advection
fusion, Radiation, *Distribution patterns,
circulation, Currents, Turbulent flow, *Es
Estuarine environment.
Identifiers: Instantaneous sources, Con
release, Deep ocean, *Coastal waters.

The physical processes of circulation and mi
the ocean, coastal waters and estuari
described. Environmental features of the
relation to advective and diffusive proces
summarized. Mathematical formulations for
processes and a set of guidelines for nuclear
evaluations are presented. Radially symm
solutions and shear diffusion solutions for
stantaneous point source are taken as fundar
The principle of superposition of the funda
solution is used to formulate solutions for a
of practical problems. Predictions with a r
symmetrical solution are made for horizon
tributions of radioactivity from instant
sources and evaluations of concentration di
tion from continuous sources. Predictions w
shear-diffusion solutions are made for the
variation of patch from an instantaneous
sized source and for the concentration distri
of plume from a continuous source. Box mod
also presented for evaluation of large scale
in oceans and estuaries. (Ensign-PAI)
W71-05324

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

**DIFFUSION AND REVERSE OSM
THROUGH POLYMER MEMBRANES,**
Princeton Univ., N.J. Frick Chemical Lab.
Gail R. Steiner, Robert F. Eaton, T. K. Kwei,
Arthur V. Tobolsky.
Available from NTIS as AD-714 899, $3
paper copy, $0.95 in microfiche. Technical R
No 127, Oct 1970. 27 p, 5 fig, 3 tab, 16 ref.
NR 056-377.
Identifiers: *Osmosis, *Membranes, *Cel
acetates, Osmosis, *Nylon, *Desalination,
branes, Polymers, Diffusion, Water, S
chloride, Permeability, Reverse osmosis, Ny
*Reverse osmosis desalination.

Theoretical and practical aspects of reverse
sis and diffusion are reviewed and discussed
special emphasis on methods of determining
sion constants and permeation constants.
scale osmosis experiments were designed to
useful data applicable to reverse osmosis sys
Measurements were made of diffusion con
and permeation constants for both water and
in two kinds of cellulose acetate and also in Ny
membranes. The results compared very wel
those found in the literature for reverse osmos
W71-04943

**OPTIMIZATION OF A SINGLE EF
MULTI-STAGE FLASH DISTILLA
DESALINATION SYSTEM,**
Illinois Univ., Urbana. Coordinated Science L
Allen Kent Coleman.
Available from NTIS as AD-713 843, $3.
paper copy, $0.95 in microfiche. Report R
Sept 1970. 46 p, 7 fig, 4 tab, 13 ref. DAAB-0
C-0199.
Identifiers: *Desalination, *Distillation, Co
Optimization, Programming, Computers, M
matical models, Salinity, Sea water.

Due to the necessity for chemically pretreatin
saline input flow to a desalination plant, it
vantageous to recycle through the condens
fraction of the brine leaving the plant to reduc
required saline input flow and thereby re
pretreatment costs. Such a system is referred
single effect or multieffect depending

whether it has one or multiple recycle loops each in series configuration. The model for the present analysis is of the single effect type. It is the purpose of the analysis to develop a reliable mathematical model for the process and to present it in a form compatible with optimization via dynamic programming. It is felt that such an approach has the advantage that given a certain demand on the system the designer can optimize his cost performance index without having to fix the number of flashing stages or the amount of product flashed in each stage. To test the model and the optimization of that model a 50 million gallon per day system has been chosen.
W71-05256

3B. Water Yield Improvement

INCREASES IN STREAMFLOW AFTER CONVERTING CHAPARRAL TO GRASS,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Alden R. Hibbert.
Water Resources Research, Vol 7, No 1, p 71-80, February 1971. 10 p, 8 fig, 1 tab, 8 ref.

Descriptors: *Water yield improvement, *Arizona, *Weed control, *Chaparral, Range management, Trees, Watershed management, Evapotranspiration control, Rainfall-runoff relationships, Arid lands, Rainfall disposition, Water yield, Demonstration watersheds.
Identifiers: *Experimental watersheds.

Water yield has increased substantially on two small chaparral watersheds in central Arizona following brush control and conversion to grass. Winter precipitation is the major source of water yield. Summer rains begin in July and normally account for about one-fourth of the annual precipitation but generally have little effect on streamflow. When annual precipitation is less than 16 inches, increase in water yield resulting from treatment is likely to be less than 2 inches. However, the efficiency of the conversion for producing extra water improves with rainfall, at least up to 34 inches. At this amount of annual precipitation, the increase in flow may reach 12 inches or more, depending on seasonal distribution of the rain. (Knapp-USGS)
W71-04855

THE EXPERIMENTAL MODIFICATION OF LAKE-EFFECT WEATHER,
Cornell Aeronautical Lab., Inc. Buffalo, N.Y.
For primary bibliographic entry see Field 02B.
W71-04951

PROJECT SKYWATER, PROCEEDINGS: SKYWATER CONFERENCE IV OPTIMIZATION OF OPERATIONAL WEATHER MODIFICATION.
Bureau of Reclamation, Denver, Colo. Office of Atmospheric Water Resources.

Available from NTIS as PB-195 887, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Report REC-OCE-70-56, May 21-22, 1968. 365 p.

Descriptors: *Weather modification, Precipitation (Atmospheric), Cloud modification, Decision making, *Research and development, Silver iodide, Investigations, *Meteoric water, Water resources, Instrumentation, Water utilization, Progress reports, Orographic clouds, Cloud physics, Cloud seeding, Orographic precipitation, Reviews.
Identifiers: USBR Research Contracts, Skywater Project.

The Bureau of Reclamation's Atmospheric Water Resources Program, called Project Skywater, is developing the capability to apply precipitation management techniques to the solution of our nation's water needs. Evolutionary processes leading toward the best precipitation management system require the identification and analysis of the many problems in weather modification. Optimization of operational weather modification is presented. The objectives of each research contract program and the procedures for meeting these objectives are given. Discussions of the balance between research and operations and the roles of educational, private, and Government institutions in weather modification, in general, and Project Skywater in particular, are summarized. A statistical summary of the opinions returned expressing the status of the present and future state of the art is included.
W71-04956

1968 FLORIDA CUMULUS SEEDING EXPERIMENT: NUMERICAL MODEL RESULTS,
National Oceanic and Atmospheric Administration, Miami, Fla. Experimental Meteorology Lab.
Joanne Simpson, and Victor Wiggert.
Monthly Weather Review, Vol 99, No 2, p 87-118, February 1971. 32 p, 32 fig, 13 tab, 34 ref. Bureau of Reclamation Contract 14-06-W-176.

Descriptors: *Cloud seeding, *Evaluation, *Florida, Mathematical models, Numerical analysis, Water yield improvement, Silver iodide, Statistical methods, Cloud physics, On-site tests, Weather modification.
Identifiers: Cloud seeding evaluation.

A one-dimensional numerical cumulus model was tested against data from a randomized seeding experiment made in South Florida in 1968. Fourteen GO clouds were studied. Nine were seeded by pyrotechnics with 1 kg of silver iodide each, while five were studied identically as controls. Various seeding subroutines and assumptions regarding the ice phase are compared. The experimental aircraft data are used to guide the modeling assumptions and to select the most realistic ones. Seedability and seeding effect correlate to 0.96 for seeded clouds in the three best models. A high correlation is found between seedability and radar-measured rainfall increase from seeding. Also, a high correlation is found between model predictions of the difference in precipitation fallout between seeded and control clouds and the measured rainfall differences, although the model predictions are much smaller in magnitude. A calculation is undertaken showing that coalescence within the cloud body on descent of the raindrops easily accounts for the discrepancy. The model predictions for each GO cloud are discussed in comparison with actual measurements on the cloud. The 1968 experiment was found to subdivide into two periods, one fair and one disturbed with quite different effects of seeding. The two periods and corresponding cloud behavior are compared. It is concluded that the disturbed period was less favorable for seeding because of higher unseeded cloud growth and strong wind shear. Implications of this result for future modeling efforts are discussed. (Knapp-USGS)
W71-05061

EVAPORATION REDUCTION WITH FLOATING GRANULAR MATERIALS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Lloyd E. Myers, and Gary W. Frasier.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE, Vol 96, No IR4, Proc. Paper 7741, p 425-436, December 1970. 2 fig, 4 tab, 12 ref.

Descriptors: *Reservoir evaporation, *Evaporation control, *Chemcontrol, Water yield improvement, Water supply, Irrigation, Evaporation.
Identifiers: Reflective materials.

Investigations were conducted to determine the feasibility of reducing evaporation from open water surfaces with white, floating granular materials which cool the water by reflecting incoming shortwave radiation. Studies were conducted on buried 7.2-m diameter tanks where almost all energy exchange occurred through the water surface. Materials evaluated were calcium carbonate dust, silica sand, polystyrene beads, chopped styrofoam and perlite. Evaporation reduction for 1 week ranged from 21% for water repellent sand to 64% for chopped styrofoam. Authors conclude that floating granular materials are feasible for reducing evaporation of expensive water from open tanks or small reservoirs with reasonably steep banks. Costs, using presently available materials, will be around $1.00 per 1000 gal. saved. (Oleszkiewicz-Vanderbilt)
W71-05138

3E. Conservation in Industry

INDUSTRIAL USE OF SURFACE WATERS IN ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality Section.
Donald H. Schnepper, and Ralph L. Evans.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, p 36-40. 3 tab, 5 ref.

Descriptors: *Industrial water, Boiler feed water, Cooling water, Industrial plants, Pre-treatment, Turbidity, Temperature, Illinois, *Water utilization, *Water uses.

Data has been accumulated through several investigations on surface water quantity, surface water sources and water quality in the state of Illinois. Information regarding the industrial use of surface waters was obtained by questionnaire and personal visits. The conclusions set forth in this presentation pertain to compilation of data from these investigations with particular emphasis on the most current investigation. (Ellis-Texas)
W71-05166

3F. Conservation in Agriculture

COST OF PUMPING IRRIGATION WATER IN ARIZONA: 1891 TO 1967,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
William E. Martin, and Thomas Archer.
Water Resources Research, Vol 7, No 1, p 23-31, February 1971. 9 p, 5 fig, 1 tab, 32 ref.

Descriptors: *Water costs, *Irrigation water, *Pumping, *Arizona, Water sources, Water supply, Water management (Applied), Water distribution (Applied), Water levels, Drawdown, Water table, Aquifers, Alluvium, Data collections.
Identifiers: *Irrigation water cost (Ariz).

The historical record of the cost of pumping groundwater in Arizona is examined. Measures used are the cost per acre-foot per foot of lift, the cost per acre-foot, the water cost per acre for important crops, and the total water cost per farm for representative general crop farms. Costs are presented in actual dollars and dollars adjusted by GNP implicit price deflators. Whereas pumping depths have been rising rapidly, costs per acre-foot per foot of lift have been falling, adjusted costs per acre-foot have been almost constant, and per acre costs and total costs relative to both total costs and total returns have fluctuated throughout the time period examined, sometimes being lower but often being higher than costs at the present time. (Knapp-USGS)
W71-04851

ECONOMIC ANALYSIS OF WATER USE IN ILLINOIS AGRICULTURE,
Illinois Univ., Urbana. Dept. of Agricultural Engineering; and Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 06B.
W71-04935

EVAPORATION LOSSES IN SPRINKLER IRRIGATION,
Florida Univ., Gainesville. Dept. of Agricultural Engineering; and Florida Univ., Gainsville. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-04938

FIFTEENTH ANNUAL WATER CONFERENCE.
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 04B.
W71-05065

IRRIGATION WATER REQUIREMENTS FOR CROP PRODUCTION IN THE ROSWELL ARTESIAN BASIN,
New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business.
For primary bibliographic entry see Field 04B.
W71-05066

IRRIGABILITY CLASSIFICATION OF NEW MEXICO LANDS,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 04B.
W71-05068

SOIL AND WATER CONSERVATION NEEDS INVENTORY, COOKE, GRAYSON AND FANNIN COUNTIES, TEXAS.
Texoma Regional Planning Commission, Tex.

Available from NTIS as PB-195 447, $3.00 in paper copy, $0.95 in microfiche. Texoma Regional Planning Commission report, Aug 1970. 47 p. HUD Project Tex P-285.
Identifiers: *Regional planning, *Texas, *Soil conservation, Regional planning, *Water conservation, Inventories, Land use, Watersheds, Forest land, Grasses, Cultivation, Floods, Soils, Irrigated land, Maps, Tables, Data, Cooke County (Tex), Grayson County (Tex), Fannin County (Tex).

The inventory includes basic data that show the kind of soil, slope, erosion and land use characteristics in Cooke, Grayson and Fannin Counties. The land use classifications are separated into cropland, pastureland, rangeland, forest and woodland and 'other'. The acreages needing treatment in the various classification are described and the treatment that is feasible for this particular soil deficiency is outlined. Forest and woodlands needing establishment, improvement, protection or windbreaks are also described. All watersheds are delineated showing the problems with flooding and conservation of water along with project actions required to solve these problems.
W71-05150

SPRAY IRRIGATION-A POSITIVE APPROACH TO PERPLEXING PROBLEM,
Oxford Paper Co., West Carrolton, Ohio.
For primary bibliographic entry see Field 05D.
W71-05165

RECLAMATION AND IRRIGATION OF LANDS BY FEDERAL GOVERNMENT.
For primary bibliographic entry see Field 06E.
W71-05188

IRRIGATION FROM UPSTREAM WATERSHED RETENTION RESERVOIRS IN OKLAHOMA,
Economic Research Service, Washington, D.C.
Gordon R. Sloggett.
Oklahoma Agricultural Experiment Station, Progress Report P-631, April 1970. 19 p, 1 fig, 12 tab, 4 ref

Descriptors: *Reservoir storage, *Watersheds (Basins), *Detention reservoirs, *Irrigation efficiency, *Oklahoma, Water conservation, Water management (Applied), Multiple-purpose reservoirs, Farm management, Investment, Irrigation systems, Irrigation practices, Income analysis, Irrigated land, Flood irrigation, Unit costs, Flood protection, Benefits, Net income, Sprinkler irrigation, Corp production, Surveys, Retention.
Identifiers: *Washita River Basin (Oklahoma), *Upstream reservoirs, Wheel move sprinkler, Skid move sprinkler, Boom irrigation.

Over 1,400 detention reservoirs were constructed in Oklahoma by the Soil Conservation Service since 1948. Farmers may use water stored in the sediment pool portion of reservoirs for irrigation. This study determined the number of farmers irrigating from upstream reservoirs; number, types and amount of investment of reservoirs and irrigation systems; and estimated income changes resulting from such irrigation. In 1969 upstream irrigators were interviewed. Largest concentration of irrigators was in the Washita River Basin from western to south-central Oklahoma. About 5,367 acres were irrigated from 89 reservoirs by 92 farmers in 1969. Irrigation systems included hand move sprinkler, flood, wheel move sprinkler, skid move sprinkler, and boom. Number of systems irrigating total acres and total cost were: 72, 4,087, $338,615; 11,658, $64,490; 4, 125, $29,300; 3, 332, $20,600; 2, 165; and $15,000, respectively. Per-acre irrigated cost varied from $62.05 for skid move sprinkler to $234.40 for wheel move sprinkler. Income increased as an unplanned benefit of flood protection. The average farmer irrigating from upstream detention increased his annual net income by over $1,691. Twelve tables give economic data on detention-reservoir irrigation. (Popkin - Arizona)
W71-05197

SELECTION AND MANAGEMENT OF IRRIGATED PASTURE MIXTURES,
Agricultural Research Service, Denver, Colo, and Montana Agricultural Experiment Station, Bozeman. Huntley Branch; and Montana Agricultural Experiment Station, Bozeman. Northwestern Branch.
C. S. Cooper, D. E. Baldridge, and C. W. Roath.
Montana Agricultural Experiment Station, Bulletin 622, February 1969. 22 p, 5 fig, 10 tab, 14 ref.

Descriptors: *Pasture management, *Forage mixtures, *Water management (Applied), *Water conservation, *Planning, Grasses, Legumes, Montana, Livestock, Planting management, Irrigated lands, Soil-water-plant relationships, Pastures, Grazing, Limiting factors, Farm management, Crop production, Labor, Unit costs, Evaluation, Economic prediction, Growth rates, Water demand, Varieties.
Identifiers: Weight gains.

There are an estimated 5 million acres of irrigated pasture in the western U.S., 10 percent of which occurs in Montana and is a major forage source for livestock. Irrigated pasture-mixture management is complex because multiple species have different and competing growth requirements. A discussion of management principles and description of major species and mixture factors are presented. Kentucky bluegrass, orchardgrass, smooth bromegrass and tall fescue are common on irrigated, well-drained soils. Six legumes--white clover, red clover, birdsfoot trefoil, alfalfa, alsike clover, and strawberry clover are recommended for irrigated pasture. Soil-water-plant relationships are discussed. Important considerations are: (1) more animals can be grazed than on range per unit land; (2) irrigated pasture produces good weight gains; (3) irrigated pastures on ranches with limited range may permit a better forage; (4) farm-management programs must be geared to forage as it is produced; (5) grass and legume mixtures yield highest production; (6) irrigated-pasture labor requirements are higher per cow than on range; (7) irrigated-pasture forage costs more per unit than range forage. Irrigated pastures are highly productive and may permit a profitable enterprise. Figures and tables show production and economic data forage species and combinations. There are references. (Popkin-Arizona)
W71-05198

AN ECONOMIC APPRAISAL OF DEVELOPIN THE HARDIN UNIT FOR IRRIGATION,
Montana State Univ., Bozenes. Dept. of Agric tural Economics.
Ralph E. Ward, and Clarence W. Jensen.
Montana Agricultural Experiment Station, Bulle 639, March 1970. 34 p, 4 fig, 10 tab, 18 ref.

Descriptors: *Comparative productivity, A praisals, *Benefits, *Land management, *La development, Irrigation programs, Properti Capital costs, Drainage engineering, Irrigati systems, Water management (Applied), Soc values, Indirect benefits, Grazing, Dry farmir Economic prediction, Economic impact, Econom efficiency, Montana.
Identifiers: *Hardin irrigation unit, *Crow Indi Reservation, *Missouri River Basin Proje Ownership, Trustland, Semiarid lands.

The Hardin irrigation unit, proposed by the Bure of Reclamation for use on the Crow Indian Rese vation, Montana, is evaluated. The unit wou make the land part of the Missouri River Basin Pr ject. The value of irrigated agriculture would about 4 times the amount now obtained by drylar and grazing. There would be substantial indire benefits from increased business activity, emplo ment opportunities, processing plants, and soci benefits such as stabilization, reduced unemplo ment, more facilities for education, transportati and electricity. Local industrial developme would be supplemented. Proposed farm uni would cut across ownership, trust and fee bound ries to create ownership and trustland problem Predevelopment requires land leveling, layouts c irrigation systems, fields and drainage because Ind an landowners cannot make capital improvement Several land control and management plans a proposed: (1) form a non-profit leasing organiz tion for development and maintain present owne ship; (2) change ownership to conform to irrigate farm units; (3) develop leasing and private co porations for development and management. Ar of these plans require a high degree of cooperatio A special educational and promotional progra emphasizing benefits and requiring local sponso ship with technical assistance is necessary. (Popki - Arizona)
W71-05200

CONSUMPTIVE IRRIGATION REQUIRE MENTS FOR CROPS IN IDAHO,
Idaho Univ., Moscow. Dept. of Agricultural En gineering; and Idaho Water Resource Board.
R. J. Sutter, and G. L. Corey.
Idaho Agricultural Experiment Station, Bulleti 516, July 1970. 97 p, 91 tab, 2 fig, 10 ref.

Descriptors: *Consumptive use, *Optimizatio *Planning, *Decision making, *Farm managemen Microclimatology, Water balance, Diversion, Cro production, Irrigation practices, Labor, Inter-basi transfers, Reservoirs, Irrigable land, Idaho, Wate requirements.
Identifiers: *Blaney-Criddle formula, *Crop quali ty, Micrometeorology, Climatic factor, Empiric methods, Evaporimeter, Semiarid lands.

Estimates of irrigation requirements for Idaho's 2. million acres of highly suitable irrigable land ar made for optimal planning projects, reservoir deci sions, interbasin transfer, efficient use, and deter mination of irrigation method, design, schedule cropping pattern, labor requirements, and farm ef ficiencies. Overirrigation is wasteful, and ma decrease yields and lower crop quality. Irrigatio requirements will establish reasonable diversio quotas under legal dispute. Estimates of consump tive use can be made by using water balance micrometeorological, evaporimeter, and empirica methods. These approaches are evaluated. Th

dified Blaney-Criddle formula assumes: (1) con-
ptive use is proportional to the climatic factor;
crops are not limited by inadequate water
ply during the growing season; (3) factors other
n temperature, percentage of daylight hours,
growing season are similar at all locations. Cli-
tological and growing-season data from 42
ather Bureau stations are calculated. Average
ual consumptive and irrigation requirement for
crops for these 42 stations are presented.
ety-one tables show irrigation efficiencies, peak
, and probability data on consumptive irriga-
requirements. (Popkin - Arizona)
1-05201

. WATER QUANTITY MANAGEMENT AND CONTROL

. Control of Water on the Surface

MERICAL SIMULATION OF FLOOD WAVE DIFICATION DUE TO BANK STORAGE EF-TS,
logical Survey, Washington, D.C.
rge F. Pinder, and Stanley P. Sauer.
er Resources Research, Vol 7, No 1, p 63-70, ruary 1971. 8 p, 6 fig, 14 ref.

criptors: *Simulation analysis, *Floods, *Bank age, *Surface-groundwater relationships, er levels, Mathematical models, Numerical ysis, Hydrograph analysis, Base flow, Channel phology, Groundwater movement, Hydro-hs, Unsteady flow, Alluvium, Allivial channels, amic programming.
tifiers: Flood waves.

modification of a flood wave due to bank age effects can be calculated by using numeri-methods. The dynamic equations describing dimensional open channel flow and the equa- for two-dimensional transient groundwater are solved simultaneously, coupled by an ex-sion for flow through the wetted perimeter of channel. Numerical experiments indicate that d waves may be modified considerably by bank ge, particularly in the lower segments of a long h, and that the degree of modification is in-ced markedly by the hydraulic conductivity of quifer. (Knapp-USGS)
-04854

REASES IN STREAMFLOW AFTER CON-TING CHAPARRAL TO GRASS,
st Service (USDA), Tempe, Ariz. Rocky ntain Forest and Range Experiment Station.
primary bibliographic entry see Field 03B.
-04855

COMPARATIVE STUDY OF CRITICAL UGHT SIMULATION,
ornia Univ., Los Angeles. Dept. of Engineer-ystems.
Askew, W. W-G. Yeh, and W. A. Hall.
r Resources Research, Vol 7, No 1, p 52-62, uary 1971. 11 p, 1 fig, 5 tab, 6 ref. OWRR Pro-3-061-CAL (6).

riptors: *Simulation analysis, *Droughts, ervoir design, *Streamflow forecasting, thetic hydrology, Runoff forecasting, Reser-peration, Statistical methods, Rainfall-runoff onships.
ifiers: *Drought simulation.

of monthly streamflow records is generated analyzed to give a set of synthetic critical ds. Some characteristics of these periods are ed, and the mean and standard deviation of values are compared with the appropriate s for the historical critical period. This procedure is repeated with three characteristics for a number of different rivers by using a variety of generating techniques. A study of the results allows a comparison between the generating techniques in regard to both their cost in computer time and their ability to synthesize critical droughts comparable to those recorded historically. The results appear to be influenced by the relative aridity of the watershed and by the size of the reservoir considered. In addition, some general conclusions can be drawn regarding the advisability of using generated streamflow in studies of reservoir design and operation. (Knapp-USGS)
W71-04861

FLOW THROUGH A TAILINGS POND EMBANKMENT,
Bureau of Mines, Spokane, Wash., and Idaho Univ., Moscow.
For primary bibliographic entry see Field 08D.
W71-04862

LAW OF STREAM RELIEF IN HORTON'S STREAM MORPHOLOGICAL SYSTEM,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02E.
W71-04866

A NEW METHOD OF DETECTING LEAKS IN RESERVOIRS OR CANALS USING LABELLED BITUMEN EMULSIONS (FRENCH),
CEA, Center of Nuclear Study of Grenoble, and Societe routiere Colas, Paris, France.
J. Molinari, J. Guizerix, and R. Chambard.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/47, p 743-760, 1970. 18 p, 11 fig, 6 ref.

Descriptors: *Tracers, *Reservoir leakage, *Canal seepage, *Tagging, *Emulsions, Groundwater movement, Soil water movement, Iodine radioisotopes, Bituminous materials, Seepage, Infiltration.
Identifiers: Leakage detection.

A method of detecting and localizing leaks in natural or artificial stored-water bodies such as lakes, canals, basins, reservoirs, or wells consists of injecting into the stored water an emulsion labelled with a radioactive tracer. The labelled emulsion is entrained into the leakage areas where emulsion particles separate from the water and accumulate. The distribution of these particles, which are proportional to the specific infiltration flow for structures with interstitial permeability, is then determined simply by measuring the radioactivity. Where the labelled emulsion is an emulsion of bitumen, the plastic properties of this product are useful in promoting the agglomeration of the particles and their adhersion to the materials of the revetment or wall to be studied. The preparation of an emulsion of bitumen labelled with iodine-131 and its application in determining permeability gradients and detecting leaks in canal revetments are described. This method has a large range of applications. It can, for example, be successfully used to study the relative permeabilities of strata in which wells, pits or boreholes have been drilled, and to distinguish between areas of varying permeabilities. (Knapp-USGS)
W71-04879

METHOD OF DETERMINING LEAKAGE VELOCITIES THROUGH THE BOTTOM OF RESERVOIRS,
Institute of Nuclear Physics, Cracow, Poland.
A. Zuber.
Supported by International Atomic Energy Agency. In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM 129/48, p761-771, 1970. 11 p, 7 fig, 11 ref.

Descriptors: *Reservoir leakage, *Tracers, Tracking techniques, Flow, Pipe flow, Porous media, Groundwater movement, Instrumentation, Velocity, Seepage, Percolation.
Identifiers: *Reservoir leakage gage.

If a chosen area leaking in a reservoir bottom is tightly covered by a cylindrical cover with an outlet through a pipe, then the product of leakage velocity and the area covered is equal to the product of flow velocity in the pipe and the pipe cross-section. Even extremely low leakage velocities render measurable velocities in the pipe if its cross-section is very small in comparison with the covered area. This idea can be used for leakage velocity measurements if the measuring device does not disturb natural flow lines. Conditions under which this requirement is satisfied are considered in detail. A measuring device constructed according to these conditions and described in the paper can measure leakage velocities from 0.0000005 to 0.003 cm/sec. The flow velocity in the measuring pipe is known from the transit time measurement of an injected pulse of a radioisotope. (Knapp-USGS)
W71-04880

FLOOD ROUTING THROUGH STORM DRAINS: PART I. SOLUTION OF PROBLEMS OF UNSTEADY FREE SURFACE FLOW IN STORM DRAINS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and A. H. Barnes.
Supported by Bureau of Public Roads and Public Health Service.Colorado State University Hydrology Paper No 43, November 1970. 107 p, 44 fig, 36 tab, 23 ref, 5 append.

Descriptors: *Routing, *Flood routing, *Storm drains, *Unsteady flow, Mathematical models, Computer programs, Hydraulic models, Waves (Water), Critical flow, Supercritical flow, Discharge (Water), Flow, Runoff, Storm runoff.
Identifiers: Storm drain flow routing.

Flood routing through storm drains was studied in a 3-ft diameter, 822-ft long storm conduit and theoretically in terms of the unsteady free-surface flow. Numerical integrations of differential equations by the specified interval scheme, the diffusing scheme, and the Lax-Wendroff scheme are discussed. The method of characteristics is selected for the practical integration procedure whenever the complete differential equations are used. Experimental and analytical investigations of the geometric and hydraulic parameters that define the coefficients of the two differential equations are summarized. The initial and boundary conditions are expressed mathematically for the numerical solutions. The analytically computed waves are then compared with the experimentally observed waves by using the same initial and boundary conditions. Qualitative and quantitative comparisons are given for depth hydrographs at different positions, for depth wave profiles at different instants in time, and for the peak-depth versus both position and time. From a practical point of view, good agreement is indicated by these comparisons. The errors in conduit geometric parameters, in hydraulic parameters, in numerical computations, and in experimental observations are analyzed and discussed. A bibliography of 145 entries is included in Appendix 2. (See also W71-04891 and W71-94892) (Knapp-USGS)
W71-04890

FLOOD ROUTING THROUGH STORM DRAINS: PART II. PHYSICAL FACILITIES AND EXPERIMENTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and A. H. Barnes.

Colorado State University Hydrology Paper No 44, November 1970. 43 p, 49 fig, 13 tab, 13 ref.

Descriptors: *Flood routing, *Storm drains, *Hydraulic models, *Colorado, Routing, Unsteady flow, Laboratory tests, Waves (Water), Instrumentation, Calibrations, Computer programs.
Identifiers: Storm drain flow routing.

Experimental storm drain routing research facilities and experiments are described. Design and construction of the experimental storm drain system, instrumentation and calibration, the data recording system, various experimental test conditions and their typical results, and experimental errors are discussed. A large conduit, 3 feet in diameter and 822 feet long, was constructed in the Outdoor Laboratory of Colorado State University to accurately measure geometric and hydraulic characteristics, and the propagating of flood waves. The calibration of the instruments has been carried out to the point where there are relatively small errors. The data recording system was designed and constructed so that the output could be put either on cards or paper tapes and provide a direct input for computations on a digital computer. (See also W71-04890) (Knapp-USGS)
W71-04891

FLOOD ROUTING THROUGH STORM DRAINS: PART III. EVALUATION OF GEOMETRIC AND HYDRAULIC PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and A. H. Barnes.
Colorado State University Hydrology Paper No 45, November 1970. 37 p, 24 fig, 12 tab, 10 ref.

Descriptors: *Flood routing, *Storm drains, *Hydraulic models, Hydraulics, Unsteady flow, Non-uniform flow, Channel morphology, Flow resistance, Hydraulic design, Shear drag, Roughness (Hydraulic).
Identifiers: Storm drain flow routing.

Results are given of investigation of the geometric and hydraulic parameters of an experimental storm drain routing facility. The errors in cross section geometric parameters are analyzed in a conduit not ideally circular but approximated by an elliptical shape; errors are also analyzed when the undulations in the longitudinal slope of the conduit affect the predicted water surface profiles and thus the geometric parameters for a given water depth. The variation of hydraulic parameter of resistance, expressed by the Darcy-Weisbach friction factor, is experimentally determined and compared to the theoretical relation to Reynolds number. Energy losses in a 90 deg junction box are studied. The velocity distribution coefficients are shown to vary with the Darcy-Weisbach friction factor, and consequently, with the depth of flow. Boundary conditions for both controlled and free outfall are experimentally determined and approximated by power functions. Two types of steady non-uniform flow profiles were observed and analyzed as the initial conditions for the unsteady flow computations. (See also W71-04890) (Knapp-USGS)
W71-04892

FLOOD HAZARD INFORMATION, ROSE CANYON AND SAN CLEMENTE CANYON, CITY OF SAN DIEGO, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps of Engineers Flood Plain Report, July 1970. 14 p, 3 fig, 15 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *California, Regional flood, Flood forecasting, Flood control, Statistical methods.
Identifiers: *San Diego (Calif), Standard project flood, Intermediate regional flood.

Flooding along Rose Canyon from its confluence with San Clementa Canyon to a point about 6 mi upstream in San Diego, California, is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating to the extent of flooding which might occur, based on available records of rainfall, runoff, historical flood heights, and other technical data. No records of past floods are available, but large floods could occur in Rose Canyon. Peak discharge of the Intermediate Regional Flood is estimated at 6,200 cfs 3.4 mi above the mouth of Rose Canyon. The Standard Project Flood peak discharge is estimated at 8,900 cfs. (Woodard-USGS)
W71-04904

FLOOD PLAIN INFORMATION, HATCHIE RIVER, PLEASANT RUN CREEK AND SPRING CREEK, BOLIVAR, TENNESSEE.
Corps of Engineers, Memphis, Tenn.

Prepared for the city of Bolivar. Corps of Engineers Flood Plain Report, August 1970. 39 p, 8 fig, 19 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Tennessee, Historic flood, Flood forecasting, Regional flood, Overflow, Design flood, River basin development, Land use.
Identifiers: *Hatchie River, Bolivar (Tenn), Intermediate regional flood, Standard project flood.

A summary of the flood situation at Bolivar, Tenn. is described to aid in solving local flood problems and for planning the best utilization of flood-prone lands. Situated on the left bank of Hatchie River between Pleasant Run and Spring Creek, Bolivar's principal residential and commercial developments are on ground outside the flood plains of the river and Spring Creek, but large portions of land potentially developable have been inundated and this study shows that even greater portions are subject to flooding in the future. Maps, profiles, cross sections, and descriptive material relating past flooding to potential flooding are based on available records of rainfall, runoff, historical flood heights, and other technical data. Records from U.S. Geological Survey stream gaging stations on Hatchie River at State Highway 18, beginning in 1929, and on Pleasant Run at the old U. S. 64 bridge, from 1954, are the basis for much of this report. The greatest flood known on the Hatchie occurred in February 1948; other great floods occurred in Janurary 1946 (second in size), and in January 1935. Winter and spring are the main flood seasons. The Hatchie River flood of 1948 rose to its crest stage in 14 days and was out of banks for 78 days. (Lang-USGS)
W71-04905

PROGRESS REPORT ON AQUATIC WEED CONTROL STUDIES,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Otto E. Naman.
Available from NTIS as PB-195 774, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Report REC-OCE-70-26, July 1970. 35 p, 5 fig, 8 tab, 9 ref.

Descriptors: *Aquatic weeds, Dispersing agents, *Herbicides, Aromatic solvents, Water analysis, Irrigation systems, *Weed control, Irrigation canals, Soil treatment, Limnology, Aquatic life, Ecology, *Aquatic weed control, Pondweeds, Phytotoxicity.
Identifiers: Carter Lake, Colo, Xylene, Product evaluation, Progress reports, Aquatic weed study facility.

Laboratory and preliminary field studies on submersed aquatic weed control methods are reported. Several experimental compounds and combinations of herbicides were evaluated for herbicidal activity in greenhouse tests. Only one material was active when applied to the aquatic soil. One new experimental herbicide, formulated allylidene diacetate, showed promise for controlling aquatic weeds in irrigation canals when applied to the total water volume. This material also active when combined with nonphyto levels of xylene. The ammonia ion was activ aquatic weeds in static water, but less effecti flowing water. Seven experimental herbicide t ments were evaluated for activity on pondwee the Carter Lake Aquatic Weed Test Station. lidene diacetate was the most promising and suggested for field testing in an operating irrig canal. Data are presented on studies for deter ing the effects of mineral nutrients on the pro tivity of 2 pondweeds. Preliminary results su that mineral enrichment of water has little d influence on pondweed productivity.
W71-04957

SYNTHESIZING HYDROGRAPHS FOR SM SEMIARID DRAINAGE BASINS,
Geological Survey, Cheyenne, Wyo.
For primary bibliographic entry see Field 02A.
W71-04972

CONSERVATION, CONTROL, AND USE WATER RESOURCES OF THE MISSO RIVER BASIN.
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04986

SURFACE WATER CONTROL IN NEW J SEY, DRAINAGE, FLOOD CONTROL AND LATED POLICIES IN AN URBAN STATE,
Rutgers-The State Univ., New Brunswick, N.J reau of Government Research.
Stephen A. Decter.
August 1967, Part I. 125 p, 137 ref.

Descriptors: *New Jersey, *Legislation, *Sur waters, *Water control, State governments, face runoff, Repulsion (Legal aspects), Ridd (Legal aspects), Judicial decisions, Legal asp Administrative agencies, Erosion, Storm ru Floowater, Flood control, Water law, Natural doctrine, Drainage, Drainage systems, Drai water, Surface-groundwater relationships, C Drainage programs, Urbanization, Water policy

Part I of a two-part report submitted by the Jersey Bureau of Government Research, this s of surface water control in New Jersey is div into three chapters: (1) framework for a water icy; (2) laws of water control; and (3) admini tion of water resources. In chapter one, basic p goals--including environmental, developme and governmental goals--problems in achie these goals, and the difficulty in determining public interest are discussed. Chapter two amines: (1) elements of water control; (2) inve ry of water control functions; (3) the cons tional-common-law framework of water con (4) authority to begin operations under statu laws of water control, including disposal and trol of surface water during ordinary wea disposal of storm surface water, control of fl waters, and acquisition of lands and waters; and collection and development of data under statu laws of water control. The criteria for appra administrative adequacy, examination of gov ment levels--including municipal, county and s levels--and inter-level coordination are discusse chapter three. (See also W71-04787) (H Florida)
W71-04995

INSTITUTIONAL DESIGN FOR WA QUALITY MANAGEMENT: A CASE STUDY THE WISCONSIN RIVER, VOL. 2, SECTIO HYDROLOGY,
Wisconsin Univ., Madison. Water Resou Center.
For primary bibliographic entry see Field 05G.
W71-05037

MULATION THEORY APPLIED TO WATER SOURCES MANAGEMENT,
vada Univ., Reno. Center for Water Resources search.
r primary bibliographic entry see Field 06A.
71-05042

OOD PLAIN INFORMATION OF RAPHANNOCK RIVER, FREDERICKSBURG, OTSYLVANIA AND STAFFORD COUNTIES, RGINIA.
rps of Engineers, Norfolk, Va.

rps of Engineers Flood Plain Report, September 70. 53 p, 11 fig, 12 plate, 11 tab.

scriptors: *Floods, *Flood plains, *Flood protion, *Virginia, Historic flood, Flood forecast, Dams, Land use, Planning, Flood damage.
ntifiers: *Rappahannock River, Intermediate gional Floods, Standard Project Flood.

is report describes flood situations along the ppahannock River in two significant phases--torical floods and probable future floods. Its purse is to help define local flood problems and how best utilize land subject to overflow. The report based on rainfall and runoff data, historical and rent flood heights, and other technical data ilable for the river basin. Maps, profiles, cross tions, and photographs are used to show the ext of past flooding and of probable future floods. e Rappahannock rises in the Blue Ridge Mountns in northern Virginia and flows southeasterly Fredericksburg where it becomes a tidal stream the next 100 mi and discharges into Chesapeake y. This report gives details for the flood plain ch from Muddy Creek upstream to Embrey m above Fredericksburg. The greatest flood of ord occurred in October 1942. The second atest was in April 1937, and was only 1 ft below 1942 flood at the USGS gaging station. Other ge floods occurred in June 1889, May 1901, y 1924, October 1924, and August 1955 (the highest). During the record 1942 flood the er had a maximum rate of rise of 3 ft per hr and ained above the 18-ft flood stage for 48 hr at edericksburg. (Lang-USGS)
71-05071

OOD PLAIN INFORMATION OF TOBESOFKEE CREEK, MACON AND BIBB COUNTY, ORGIA.
rps of Engineers, Savannah, Ga.

rps of Engineers Flood Plain Report, June 1970. p, 18 fig, 49 plate, 14 tab.

scriptors: *Floods, *Flood plains, Flood nage, *Georgia, Regional flood, Historic flood, od forecasting, Design flood.
ntifiers: *Tobesofkee Creek (Bibb County,).

oding along Tobsofkee Creek near Macon, orgia, is described to aid in solving local flood blems and in planning the best utilization of od-prone lands. Maps, profiles, cross sections, l text material relating the extent of past floods to floods which might occur in the future are ed on available records of rainfall, runoff, torical flood heights and other technical data. cords from U. S. Geological Survey stream gag stations were used to determine flooding, inding that caused by backwater from Ocumulgee er. The greatest flood known on this creek ocred in September, 1929, and other large floods curred in December 1941, March 1944, cember 1964. The analysis indicates that interdiate regional floods (100 year avg occurrence) uld be about 3 ft higher than the March 1944 od. Duration of floods is short, stages can rise m stream bed to extremes peaks in less than 12 after intensive rainfall. Hazardous conditions cur during large floods as a result of rapid rise of ter, high velocities, and deep flows. (Woodard-GS)
71-05072

ANALYSIS OF RESERVOIR YIELD,
Missouri Univ., Columbia. Dept. of Civil Engineering.
Allen T. Hjelmfelt, Jr.
Water and Sewage Works, 1970 Reference Number, Vol 117, p R14-R15, November 28, 1970. 2 p, 3 fig, 5 ref.

Descriptors: *Reservoir yield, *Mathematical models, *Equations, *Hydrology, *Statistical methods, Analytical techniques, Water supply, Planning, Water resources, Probability, Forecasting, Reservoirs.
Identifiers: Projections.

A probabilistic method for determining the expected yield of reservoirs is described. The aim of the analysis is to establish the probability of not being able to meet the demand. The results of the computations are shown. The probability of the reservoir ending a cycle at a given level or less is graphed against time. The lines are drawn only to indicate trends; they do not indicate a continual process during the year. As time progresses the lines approach the horizontal. That indicates that the distribution is stationary. The analytical method described is easy to use and results in a more meaningful solution than do the more simple mass diagram approaches. For practical application the reservoir would have to be divided into many more levels, resulting in a larger system of equations to be solved. (Woodard-USGS)
W71-05081

LAKES--RESTORATION AND PRESERVATION,
Federal Water Quality Administration, Cincinnati, Ohio. Field Investigations Branch.
For primary bibliographic entry see Field 05C.
W71-05082

POTENTIAL ALGICIDES FOR THE CONTROL OF ALGAE,
Los Angeles County Sanitation District, Calif.
For primary bibliographic entry see Field 05G.
W71-05083

EXPERIMENTAL FLUME INVESTIGATION OF HYDRAULIC TRANSIENTS IN RIVER-RESERVOIR SYSTEMS,
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 02E.
W71-05087

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA - VOLUME I.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05090

SOME RECENT RESEARCH ON LAND DRAINAGE,
Iowa State Univ., Ames. Water Resources Research Inst., and Alexandria Univ. (Egypt). Dept. of Soil Sciences.
Don Kirkham, and H. Baker.
Agrokemia es Talajtan (Agrochemistry and Soil Science), Vol 18, Supplementum, p 295-306, 1969. 12 p, 13 fig, 23 ref. OWRR Project A-003-IA (10) and B-002-IA (5).

Descriptors: *Drainage, *Leaching, *Saline soils, Land reclamation, Salinity, Diffusion, Groundwater movement, Soil water movement, Irrigation water, Infiltration, Percolation.
Identifiers: *Land drainage effects.

Some recent theoretical and laboratory research at Iowa State University, Ames, Iowa, USA is reviewed under the headings: (1) removal of sodium salts from soil by different methods of application of water; (2) drainage of stratified soils; (3) drainage of land underlain by an artesian aquifer; (4) improvements in the theory of the piezometer method for assessing soil drainability; and (5) depth of moisture penetration in soil due to irrigation water advancing over the soil surface. (Knapp-USGS)
W71-05102

EFFECT OF HANFORD PLANT OPERATIONS ON THE TEMPERATURE OF THE COLUMBIA RIVER, 1964 TO PRESENT,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05C.
W71-05116

STATISTICAL RELATIONSHIPS BETWEEN STORM AND URBAN WATERSHED CHARACTERISTICS,
Utah State Univ., Logan. Water Research Lab.
V. V. Dhruva Narayana, M. Akbar Sial, J. Paul Riley, and Eugene K. Israelsen.
Available from NTIS as PB-197 853, $3.00 in paper copy, $0.95 in microfiche. Completion Report PRWG 74-2, August 1970. 55 p, 11 fig, 15 tab, 47 ref, 2 append. OWRR Project B-025-UTAH (4).

Descriptors: Urbanization, Statistical hydrology, Watershed studies, Hydrology, Surface runoff, Urban parameters, Runoff characteristics, Illinois, *Forecasting, *Drainage.
Identifiers: *Statistical hydrology, *Flood frequency, Parameters runoff, Storm vs runoff characteristics, Small watershed runoff estimates, Urbana (Ill), Urban hydrology, *Urban drainage, Boneyard Creek (Ill).

Because of the rapid urban development in recent years, hydrologic problems associated with urban watersheds have gained importance. Large sums of money are being spent for the design of urban drainage systems based upon inadequate procedures for predicting peak runoff rates. A procedure is proposed for predicting peak runoff rates from small urban and rural watersheds based upon measurable storm and watershed characteristics. The technique was tested for a number of runoff events on the Boneyard Creek watershed at Urbana, Illinois, and the results of this test are included. The procedure will be particularly useful for estimating runoff rates from small ungaged drainage areas, and thus will be directly applicable to both design and water management problems.
W71-05144

PROBLEMS IN DEVELOPING A NATIONAL FLOOD-PROTECTION POLICY,
American Water Works Association, New York.
Gordon F. White.
In: Water, Health, and Society, Bloomington, Indiana University Press, 1969, p 148-159.

Descriptors: *Flood control, *Water resources development, *Water uses, Engineering, Hydrology, Social aspects, Economic evaluation, Hydrology, Forests, Soil conservation, Dams, Cost-benefit analysis, Water supply, Reservoirs, Irrigation, Navigation.
Identifiers: *Muskingum River, *Multiple use development.

The shortcomings in national flood protection measures are discussed in order to clarify the problems involved in developing a national flood protection policy. Considerable damage is caused by incomplete engineering studies of past destructive floods. The author calls for an accurate assessment of local and national needs in order to provide a more accurate cost-benefit analysis. There is a need for detailed programs of flood protection that meet the social and economic needs of all water uses. The author cites the interrelationship between a National Flood Protection Policy and a general National Water Resources Policy. The elements of such a policy are proposed to run the gamut of engineering, finance, administration, politics, and economics. The ultimate goal of such

national policy would be a basic Water Resources policy, changing in character, logical in administration and geared to the needs of the consumer. Government and private agencies callaberation on various studies to bring this about are surveyed in light of their proposed contribution to eventual successful policy-making. (Murphy-Rutgers)
W71-05228

STABILITY OF CLOSED HORIZONTAL DRAINAGE IN THE GOLODNAYA STEPPE,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08D.
W71-05254

4B. Groundwater Management

POROSITY AND DISPERSION CONSTANT CALCULATIONS FOR A FRACTURED CARBONATE AQUIFER USING THE TWO WELL TRACER METHOD,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 02F.
W71-04859

PERTURBATION SOLUTIONS OF THE DISPERSION EQUATION IN POROUS MEDIUMS,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02F.
W71-04860

INFLUENCE CHART FOR REGIONAL PUMPING EFFECTS,
Hydrologic Commission of the Valle de Mexico Basin, Mexico City.
German E. Figueroa Vega.
Water Resources Research, Vol 7, No 1, p 209-210, February 1971. 2 p, 1 fig, 4 ref.

Descriptors: *Drawdown, *Hydrogeology, Water wells, Aquifers, Transmissivity, Storage coefficient, Mathematical studies, Groundwater movement, Water table, Flow nets.
Identifiers: Mexico.

If water is withdrawn from a confined aquifer by wells that are areally distributed over arbitrary portions of the aquifer, the resulting drawdowns are variable with time and space. An influence chart is presented that, within its own limitations, makes possible the calculation of the regional effects of pumping without the help of analog or digital models. (Knapp-USGS)
W71-04867

MATHEMATICAL MANAGEMENT MODEL--UNCONFINED AQUIFER,
Texas Tech Univ., Lubbock. Water Resources Center; and High Plains Underground Water Conservation District No. 1, Lubbock, Tex.
For primary bibliographic entry see Field 02F.
W71-04931

STATUS OF SALT-WATER ENCROACHMENT IN 1969 IN SOUTHERN NASSAU AND SOUTHEASTERN QUEENS COUNTIES, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 02L.
W71-04976

STEADY STATE FLOW AROUND A WELL IN A TWO-LAYERED AQUIFER,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W71-05044

SPACING OF DRAINAGE WELLS IN A LAYERED AQUIFER,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W71-05045

FIFTEENTH ANNUAL WATER CONFERENCE.
New Mexico State Univ., University Park. Water Resources Research Inst.

Proceedings Fifteenth Annual Water Conference, March 12-13, 1970, New Mexico State University Water Resources Research Institute, Las Cruces, 1970. 113 p. OWRR Project A-999-N Mex (5).

Descriptors: *Water resources development, *Water supply, *Water utilization, *New Mexico, *Water management (Applied), Water requirements, Groundwater, Surface waters, Water conservation, Water pollution, Irrigation, Domestic water, Municipal water, Stock water, Planning, Interstate, Ecology, Soil properties, Social needs, Benefits, Costs, Water demand, Water balance.
Identifiers: *Water Conference (New Mexico).

Seventeen papers concerning water resources development were presented at the 1970 Annual Water Conference sponsored by the New Mexico Water Resources Institute. Emphasis was on planning, management, research, utilization, costs, quality, benefits, standards, and classification of water needs in New Mexico. (See also W71-05066 thru W71-05068) (Woodard-USGS)
W71-05065

IRRIGATION WATER REQUIREMENTS FOR CROP PRODUCTION IN THE ROSWELL ARTESIAN BASIN,
New Mexico State Univ., University Park. Dept. of Agricultural Economics and Agricultural Business.
Robert R. Lansford.
In: Proceedings Fifteenth Annual Water Conference, March 12-13, 1970, New Mexico State University Water Resources Research Institute, Las Cruces, p 79-91, 1970. 13 p, 4 fig, 2 tab. OWRR Project A-999-N Mex (5).

Descriptors: *Irrigation water, *Water requirements, *Groundwater, *Crop production, *New Mexico. Artesian wells, Water rights, Irrigated land, Legal aspects, Water law, Economic import, Crop response, Model studies, Mathematical models, Linear programming, Cost-benefit analysis, Economics.
Identifiers: *Roswell Artesian Basin (New Mexico).

In 1966 judgment and decree defined water rights in the Roswell Artesian Basin, New Mexico. The duty of water for irrigated agriculture was established at three acre-feet per acre per annum, only to be exceeded in any one year provided that the total amount diverted during any period of five consecutive years shall not exceed five times the annual duty of water. A study was initiated to assemble and analyze existing cropping patterns, water use, water quality, soil quality, crop yields, and income effects from the judgment and decree. This paper is concerned with the economic or income aspects. The data for the analysis was derived from information obtained on 12 case study farms for the calendar years 1966, 1967 and 1968. Linear programming was chosen as an analytical tool for the economic analysis. The primary purpose was to determine the effect of different quantities of irrigation water on net farm returns. A typical farm budget was developed to compare with results of linear programming to determine the economic effect of restricting the diversion of irrigation water at seven different levels. The average net farm return was $91.35 per water-right acre. (See also W71-05065) (Woodard-USGS)
W71-05066

OBJECTIVES OF A CURRENT STUDY SALINE GROUNDWATER IN THE TULA BASIN, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
J. S. McLean.
In: Proceedings Fifteenth Annual Water ference, March 12-13, 1970, New Mexico University Water Resources Research Inst Las Cruces, p 95-100, 1970. 6 p, 3 fig. OWRR ject A-999 N Mex (5).

Descriptors: *Groundwater, *Saline water, * quality, *Saline water systems, *New M Water resources, Fresh water, Water utiliz Consumptive use, Aquifers, Water wells, yield, Irrigation water, Domestic water, water, Municipal water.
Identifiers: *Tularosa Basin (New Mexico).

This study of the saline-water resources of th larosa Basin, New Mexico, delineates the and volume of saline-water zones of spe ranges in concentration; determines the yie present wells; and estimates the potential yie future wells completed in the saline-water z Fresh water was defined as water containin than 1 gram per liter of dissolved solids. Two water lenses occur in the alluvial fill adjacent mountains of the east and west sides o southern part of the basin. The water in the al fill increases in salinity with depth below fresh-water lenses. Salinity also increases to the center of the basin where water three tim saline as sea water has been found. Ground containing 1 to 3 grams per liter of dissolved is used for municipal, domestic, stock, and i tion supply. Only a few stock wells use water taining 3 to 10 grams per liter of dissolved s Groundwater containing more than 35 gra dissolved solids per liter (about the salinity o water) may be present in over 90% of the al fill in the basin. Wells in the basin yield from gallons per minute to 1,400 gallons per mi (See also W71-05065) (Woodard-USGS)
W71-05067

IRRIGABILITY CLASSIFICATION OF MEXICO LANDS,
New Mexico Agricultural Experiment Sta University Park.
J. U. Anderson.
In: Proceedings Fifteenth Annual Water ference, March 12-13, 1970, New Mexico University Water Resources Research Insti Las Cruces, p 104-106, 1970. 3 p, 1 tab, 1 OWRR Project A-999 N Mex (5).

Descriptors: *Irrigable land, *Land classifica *Irrigation, *New Mexico, Land developm Soils, Soil properties, Soil moisture, Reten Salinity, Soil density, Permeability, Porosity, structure, Drainage, Soil types, Soil water m ment, Topography, Soil-water-plant relationshi
Identifiers: *Irrigability classification.

A proposed new classification system establi four classes of irrigable land and one class of irrigable land in New Mexico. Class 1 land has or no limitations for irrigation; class 4 land has severe limitations; class 6 land is non-irrigable. criteria used to determine irrigation land class tabulated. The suitability of New Mexico lands irrigation is highly variable. In the counties w have been studied in eastern New Mexico, amount of class 1 land varies from 61.5% in C County to 1% in Lea County, and the total irrig land varies from 94% in Curry to 34% in E County. In southwestern New Mexico Luna Co has 13% class 1 and 64% total irrigable land Hidalgo the comparable figures are 10 and 4 The factors that most frequently limit the suitab of New Mexico soils for irrigation are insuffic available water holding capacity, and insuffic effective soil depth. However, the results do s extensive areas which are in classes 1 and 2, are thus very well suited to irrigation. (See W71-05065) (Woodard-USGS)
W71-05068

YDROLOGIC IMPLICATIONS OF SOLID-
ASTE DISPOSAL,
eological Survey, Washington, D.C.
or primary bibliographic entry see Field 05B.
71-05094

OFT WATER SUPPLY FOR URBAN CON-
MPTION, A FEASIBILITY STUDY,
ater Planning for Israel Ltd., Tel-Aviv.
Dalinky.
: The Proceedings of the Jerusalem International
nference on Water Quality and Pollution
search, p 79-87, June 1969.

scriptors: *Groundwater, Economic feasibility,
recasting, Cost-benefit analysis, Aquifer.
ntifiers: *Soft-water supply, Hard-water, Public
penditures.

unicipal water supply in Israel is based mainly on
undwater sources that have a high degree of
rdness because of the chemical composition of
aquifers. The author first considers the in-
ence of water hardness on the consumption of
ps and detergents and finds direct relationships
st. Furthermore, water hardness is related to
ater wear of clothing. An economic analysis of
savings or benefits due to the use of a soft water
ply is made. The largest savings are found in the
duction of salt expenditures for ion-exchange sof-
ing plants that are used in hospitals and indus-
. Savings are also found in the reduction of
thes wear-and-tear and in soap consumption.
e analysis does not consider the costs associated
h the use of soft water; namely, the problems
sing from internal corrosion of unlined pipes
ich is necessary for a cost-benefit analysis of the
sibility of soft water supply. This article is rele-
nt to studies of this same problem in the United
tes. (Siegenthaler-Rutgers)
71-05215

ATER RESOURCE MANAGEMENT IN ARID
VIRONS,
ources for the Future, Washington, D.C.; and
a State Univ., Ames.
G. Cummings, and D. L. Winkelman.
ter Resources Research, Vol 6, No 6, p 1559-
58, December 1970.

scriptors: *Water resource management,
uifers, Resource allocation, Discount rate, In-
st rate, Depreciation, Economic efficiency.
ntifiers: *User cost, Lagrangian multiplier, Sen-
vity analysis.

analytical model is presented which results in
imum decision rules for the conjunctive
nagement of a reservoir and an aquifer in arid
ons. First, the decision environment for water
urce management in arid environs is
eloped. The model focuses on several interre-
d questions associated with maximizing a
efit function based on agriculture production
given stocks of water and expected water
eipts, namely, the optimum pattern of land use
production, the optimum intertemporal alloca-
of water and the optimum rate of investment in
ital for water distribution. Extraction of water
n the reservoir and aquifer is found at the point
re the value of current groundwater in present
e terms is equal to the marginal expected value
he groundwater stock. The marginal storage
e of the reservoir stock is discounted by a
tal survival factor to arrive at benefits net of
reciation effects. The optimum rate of invest-
t at each land group is found where the ex-
ed marginal costs of investment equal the mar-
l expected value of investment discounted by
rest rates and depreciation. (Siegenthaler-Rut-
)
1-05216

OTOGRAPHIC EVALUATION OF WATER
LLS,
ne Texas Co., Inc., Houston.
primary bibliographic entry see Field 07B.
1-05299

APPLICATION OF ROTARY DRILLING TO WATER WELLS,
J. P. Miller Artesian Well Co., Brookfield, Ill.
For primary bibliographic entry see Field 08A.
W71-05307

USE OF GEOPHYSICAL LOGS IN SOIL ENGINEERING,
Mandrel Industries, Houston, Tex. Well Instrument Div.
For primary bibliographic entry see Field 08D.
W71-05310

WATER WELL INCREASING COSTS OF INSTALLATION AND MAINTENANCE,
Layne Texas Co., Houston, Tex.
For primary bibliographic entry see Field 08G.
W71-05319

4C. Effects on Water of Man's Non-Water Activities

STORM RUNOFF RESPONSE FROM ROAD-BUILDING AND LOGGING ON SMALL WATERSHEDS IN THE OREGON COAST RANGE,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
Frederic Shu-kong Hsieh.
M.Sc. Thesis, Oregon State University, June 1970. 149 p, 38 fig, 16 tab, 79 ref, 4 append. OWRR Project A-001-OREG (6).

Descriptors: *Storm runoff, *Small watersheds, *Lumbering, *Oregon, Overland flow, Road construction, Forest fires, Streamflow, Flow rates, Peak discharge, Vegetation effects, Hydrology, Rainfall, Topography, Climates, Soils, Geology, Mathematical studies, Equations, Clear-cutting.
Identifiers: *Runoff response variables, *Logging (Timber).

The effects of roadbuilding, logging, and forest burning upon stream runoff responses to storms are evaluated for the Alsea experimental watersheds, located in the Oregon Coast Range. The parameters analyzed are peak discharge, time-to-peak, and storm-runoff volume. The volume parameter is further subdivided into toal, quick, delayed, rising limb, and falling limb flows. The control-watershed approach and linear regression method are utilized. Calibration of the main stations at Flynn Creek (502 acres) and Deer Creek (750 acres) started in 1958. That for subwatershed DC II (138 acres) and DC III (100 acres) started in 1962. The storm-runoff responses were related to the type of treatment applied and percent of area treated. Roadbuilding resulted in significant increases in peak and induced peak discharges on DC III, which was subjected to the most intensive treatment. Logging generally caused greater runoff than did roadbuilding, because more vegetation was removed. Rising limb flow on DC III as well as at the Deer Creek main station was moderately increased after logging. Effects on design floods after treatments were indicated by the sharp increases in peak discharges, based upon flood frequency and statistical analyses. (Woodard-USGS)
W71-04968

WISE USE OF FLOOD PLAINS.
New England River Basins Commission, Boston, Mass.
For primary bibliographic entry see Field 06F.
W71-04994

STATISTICAL RELATIONSHIPS BETWEEN STORM AND URBAN WATERSHED CHARACTERISTICS,
Utah State Univ., Logan. Water Research Lab.
For primary bibliographic entry see Field 04A.
W71-05144

4D. Watershed Protection

CONTROL OF WATER POLLUTION DURING DAM CONSTRUCTION,
California State Dept. of Water Resources, Sacramento; and Santa Ana Regional Water Quality Control Board, Riverside, Calif.
For primary bibliographic entry see Field 05G.
W71-04888

THE ESTABLISHMENT OF VEGETATION ON NONTOPSOILED HIGHWAY SLOPES IN WASHINGTON,
Washington State Univ., Pullman. Agricultural Research Center.
Roy L. Goss, Robert M. Blanchard, and William R. Melton.
Available from NTIS as PB-196 158, $3.00 in paper copy, $0.95 in microfiche. Final Report Research Project Y-1009, Nov 1970. 29 p, 8 fig, 6 tab, 24 ref. DOT supported.
Identifiers: *Highways, *Vegetation, *Erosion control, Washington State, *Landscaping, Highways, Slopes, Loams, Grasses, Mulches, Straw, Asphalts, Emulsions, Subsoil, Fertilizers.

Various factors of erosion control and vegetation establishment were studied over a four year period in Washington. Included were: (1) establishment of grass/legume cover without the use of topsoil, (2) species of grasses and clover and proportion of each, (3) mulching materials and (4) fertilization. Erosion control vegetation can be established on subsoils without topsoil. There were no differences found among genera and species of seed tested. Subsoils, as exposed from construction, supported good stands of grass provided adequate fertilizers were supplied and they were given proper protection (mulching) from erosion. On erodible sites on 2:1 slopes or steeper, excelsior matting or straw tacked with asphalt emulsion was superior to all other materials tested. Refertilization is important.
W71-05147

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

NUTRIENTS IN STREAMS DRAINING WOODLAND AND FARMLAND NEAR COSHOCTON, OHIO,
Agricultural Research Service, Beltsville, Md. Soils Lab.
For primary bibliographic entry see Field 05B.
W71-04856

STABLE CARBON ISOTOPES IN BLUE-GREEN ALGAL MATS,
Texas Univ., Port Aransas. Inst. of Marine Science; and Texas Univ., Port Aransas. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02L.
W71-04873

DISTRIBUTION OF BACTERIA IN FECES OF SWINE,
Missouri Univ., Columbia.
Gloria D. Rall, Arletta J. Wood, R. B. Wescott, and A. R. Dommert.
Applied Microbiology, Vol 20, No 5, p 789-792, Nov 1970. 3 tab, 2 fig, 12 ref. Public Health Service grants RR-00390 and RR-00285.

Descriptors: *Bacteria, *Distribution, Farm wastes, Patterns, Microorganisms, Pollutant identification.
Identifiers: *Fecal samples, *Swine, Frequency, Distribution.

A new technique is described for evaluating bacterial cell distribution in fecal samples. Spatial rela-

tionships of cells within an area rather than number of cells per unit volume or weight are measured by this technique. Measurements of cell distribution by this method indicated that bacteria occurred in freshly voided swine feces as pure, discrete colonies rather than as single cells distributed randomly or uniformly throught the sample. (Christenbury-Iowa State)
W71-04923

ODOR TRANSPORT BY PARTICULATE MATTER IN HIGH DENSITY POULTRY HOUSES,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
William E. Burnett.
Poultry Science, Vol 48, No 1, p 182-185, 1969. 1 fig, 1 tab, 9 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, Gas chromatography, Volumetric analysis, Volume, Filters, Nitrogen, Organoleptic properties, Ventilation, Pollutant identification, Air pollution, Pollution abatement.
Identifiers: *Particulate matter, Odor transport, Odor panel, Volatiles, Concentrations, Odoriferous components.

The report investigates the concentrations of airborne particulate matter in a high density poultry house and the role of particulate matter as an odor transport mechanism. Particulate matter collected by high volume samplings, of a commercial poultry house atmosphere revealed that the particulates had a 'chicken house' odor. Gas chromatographic analyses of the volatiles carried by the particulates revealed the presence of a number of individually odoriferous compounds. Large quantities of particulate matter are probably expelled from poultry houses by ventilation fans. Whether particulate matter plays a significant role in ambient odors from poultry houses should be investigated since the particulates represent a retentive source of odors. (White-Iowa State)
W71-04924

AUTOMATED METHOD FOR DETERMINING AND REMOVING SILICA INTERFERENCE IN DETERMINATION OF SOLUBLE PHOSPHORUS IN LAKE AND STREAM WATERS,
Guelph Univ. (Ontario). Dept. of Soil Science.
F. Ross Campbell, and R. Leslie Thomas.
Environmental Science and Technology, Vol 4, No 7, p 602-604, 1970. 2 fig, 1 tab, 9 ref.

Descriptors: *Analysis, *Analytical techniques, *Color reactions, Data collections, Ammonium compounds, Phosphorus, Silica, Automation.
Identifiers: *Ammonium molybdate, Auto-analyzer techniques.

The ability of ammonium molybdate to attain blue color in the presence of not only phosphorus, but also silica, yields erroneous results in analyses of lake and stream waters. The deviations are of particular importance when the concentration of phosphorus is in the low microgram/liter range. The method described in this report permits an automated simultaneous determination of soluble phosphorus and the silica interference. (Wilde-Wisconsin)
W71-04962

DETERMINATION OF PROTEIN IN WASTE WATER,
Texas Western Coll., El Paso. Dept. of Civil Engineering.
Calvin Woods.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, July 1965, p 501-515. 7 fig, 4 tab, 16 ref.

Descriptors: *Protein, *Nitrogen, *Colorimetry, Color, Calibrations, Peptides, Carbohydrates, Ammonia, Temperature, Waste water treatment, *Pollutant identification, *Analytical techniques.
Identifiers: *Kjeldahl method, Folin reaction, Biuret reaction, Sensitivity, Optical density, Interference, Tyrosone, Tryptophan.

The Kjeldahl organic nitrogen method, the Folin colorimetric method, and the Biuret reaction were analyzed as to their ability to determine the amounts of protein present in a solution. The Kjeldahl method measures organic nitrogen in the solution. Since protein is approximately 16% nitrogen, the nitrogen concentration is assumed to be entirely present in the protein structure and is multiplied by 100/16 or 6.25 to give the protein concentration. This method requires specialized equipment, is expensive, and time consuming. The Biuret reaction involves addition of a weak concentration of copper sulfate to an alkaline solution of proteins to yield a characteristic purple color, indicating the presence of a peptide bond. However, ammonia must be removed prior to the test since it interferes with the reaction. The amount of color developed depends upon the number of peptide bonds present so each protein has a different color. This reaction is the least sensitive of the methods discussed. The Folin reaction is the result of two reactions: the reaction of copper with protein in an alkaline solution and the reduction of the phosphomolybdic-phospho-tungstic reagent by the copper treated protein. This reaction has no known interferences, it is 100 times more sensitive than the Biuret reaction, it is easy to perform, and it is the only one specifically adapted to determining the soluble protein content of waste waters after centrifugation. (Lowry-Texas)
W71-05029

ENERGY, TOTAL CARBON, AND OXYGEN DEMAND,
Rice Univ., Houston, Tex. Dept. of Chemical Engineering.
A. W. Busch.
Proceedings Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 457-469, July 1965. 6 fig, 2 tab, 25 ref.

Descriptors: *Organic matter, *Oxygen demand, *Energy, Carbon, Thermodynamics, Biological treatment, Biochemical oxygen demand, Biodegradation, Chemical oxygen demand, Waste water treatment, Oxidation, Organic wastes, *Pollutant identification.
Identifiers: *Total carbon, Substrate, Total carbon analyzer, Organic pollution.

Certain concepts held basic to the measurement of organic pollution are emphasized and data relating to the use of parameters other than oxygen consumption for organic pollution definition and measurement are presented. Only soluble organics are of basic significance in biological oxidation. Work at Rice University has resulted in the definitions of two methods for the measurement of biodegradable soluble organics: (1) a materials balance technique of extreme precision suited only for research work, and (2) a rapid, mass culture technique of plus or minus 10 percent precision suitable for waste characterization process design, and plant control. The application of thermodynamic concepts derived for reversible reactions at equilibrium to biological reactions which operate at a point remote from equilibrium seems hazardous. Total carbon changes during bio-oxidation provide a significant and useful measure of the reaction and the bio-degradable organic content. The ease and rapidity of the mass culture technique in conjunction with the total carbon analyzer offers an exciting prospect for definitive pollution measurements. (Ellis-Texas)
W71-05031

SUBMERSIBLE RECORDING CURRENT AND WATER QUALITY METERS,
Ontario Water Resources Commission, Toronto.
M. D. Palmer.
Water and Sewage Works, 1970 Reference Number, Vol 117, p R64-R70, November 28, 1970. 7 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Water quality, *Currents (Wa
*Lake Erie, *Data collections, *Instrumenta
Hydrologic data, Model studies, Computer mo
Chemical analysis, Current meters, Electr
equipment, On-site tests, Telemetry, Flow r
Water yield, Water resources, Water measurem
Identifiers: Water intakes, Waste outfalls.

Some applications for water management b
upon information gathered from a small compl
self-contained submersible water quality meter
a recording current meter operated on Lake Er
Nanticoke are discussed. Statistical methods o
terpreting the data are described and it was
cluded that the utilization of recording mete
the nearshore areas of lakes provides the neces
data for a computer model which will indicate
The best location for water intakes and waste
falls from the dilution point-of-view; and (2)
acceptable discharge concentrations and flow
the basis of not exceeding desirable values at
tions in the proximity of the discharge point
probability basis. (Woodard-USGS)
W71-05084

**QUALITY OF SURFACE WATERS OF T
UNITED STATES, 1965, PARTS 12-16.**
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05089

**COLORIMETRIC DETERMINATION OF
SOLVED OXYGEN AT LOW CONCENT
TIONS,**
Washington Univ., Seattle. Dept. of Oceanogra
For primary bibliographic entry see Field 02K.
W71-05108

**SPECTROPHOTOMETRIC DETERMINAT
OF HYDROGEN SULFIDE IN NATU
WATERS,**
Washington Univ., Seattle. Dept. of Oceanogra
For primary bibliographic entry see Field 02K.
W71-05109

**A TEST SIMULATION OF THE TEMPE
TURES OF THE DEERFIELD RIVER,**
Battelle Memorial Inst., Richland, Wash. Pac
Northwest Lab.
For primary bibliographic entry see Field 05B.
W71-05128

**ENVIRONMENTAL MONITORING - BRIT
POLICY AND PROCEDURES,**
United Kingdom Atomic Energy Authority, H
well (England). Authority Health and Sa
Branch.
H. J. Dunster.
International Atomic Energy Agency Symposi
on Environmental Aspects of Nuclear Power
tions, New York, August 10-14, 1970. Prep
SM-146/25. 6 p, 2 tab, 9 ref.

Descriptors: *Monitoring, *Thermal polluti
*Environment, Radioisotopes, Powerplants, Po
tant identification.
Identifiers: *United Kingdom, *Surveillance p
grams, Sulfur dioxide, Ash.

Monitoring of the environment is one of
techniques used in assessing the significance
releases of potential pollutants and maintain
control over such releases. The British policy
these monitoring programs is summarized and il
trated by examples of surveys for radioact
materials, thermal effects, sulfur dioxide and d
The discharge of waste from most applications
radioactive materials are small and not likely to
crease greatly even in cases of maloperation exc
for fuel reprocessing plants. It is concluded fr
100 surveys that it is very difficult to identify
contribution of sulfur dioxide or dust from the s
tion against the background from other sourc
(Upadhyaya-Vanderbilt)
W71-05135

**COLOGY OF SCHISTOSOME DERMATITIS
WESTERN AND NORTHERN NEVADA
ATERS,**
evada Univ., Reno. Center for Water Resources
esearch.
onald L. Church.
vailable from NTIS as PB-197 854, $3.00 in
per copy, $0.95 in microfiche. Project Report
ries, No. 14, August 1969. 15 p, 9 ref, 3 append.
WRR Project A-027-NEV (1).

escriptors: *Fresh water, *Nevada, *Human dis-
ses, *Aquatic animals, *Animal parasites, Inver-
brates, Snails, Hosts, Parasitism, Ecology, Life
cles, Animal control, Systematics, Census.
entifiers: *Disease control, *Schistosome
rmatitis, *Schistosomes, Flukes.

man dermatitis caused by schistosome flukes
been periodically reported from Nevada
ters. The dermatitis-causing schistosomes are
rasites of some species of freshwater snails, and a
vey of freshwater snails of western and northern
vada was made. Both a bibliography and a tax-
omic name list for freshwater snails of western
northern Nevada are appended to this report,
ng with a catalogue of snails collected and
served, giving localities, number and dates. Liv-
snails were kept in aquaria for several weeks at
ime and carefully observed for evidences of
istosome parasites, but none were observed. Ex-
inations of voles and muskrats likewise
duced no schistosomes. Further research was
icated. Expanding use of waters for recreation
y expose more people to schistosome dermatitis,
more information is needed in order to control
breaks effectively. (Yensen - Arizona)
1-05194

**N'T BE HALF-SAFE--THE CURRENT
VOLUTION IN BIOASSAY TECHNIQUES,**
nsas Univ., Lawrence. Dept. of Zoology.
n Cairns, Jr.
ceedings, Industrial Waste Conference, 21st,
y 3, 4, 5, 1966. Engineering Bulletin of Purdue
versity, Vol L, No 2, p 559-567, March 1966. 5
13 ref.

criptors: *Bioassay, *Analytical techniques,
ndicators, *Pollutant identification, Toxicity,
ter analysis, Lethal limit, Oxygen, River
ems.

re are many more bioassay techniques available
are being used and failure to make full use of
e is the result of our attitude towards our river
ems rather than becuase of any inherent faults
the techniques themselves. Examples of
niques available for fish are oxygen consump-
, cruising speed, acetylcholine esterase concen-
on, embryonic development, and histological
nges. A cooperative approach which would pro-
maximum information at the least cost and
nit the fullest reasonable industrial use of a
system as well is called for. (Ellis-Texas)
-05288

**NDARD METHODS FOR DETERMINA-
N OF RELATIVE TOXICITY OF OIL
PERSANTS AND MIXTURES OF DISPER-
TS AND VARIOUS OILS TO AQUATIC OR-
ISMS,**
eral Water Pollution Control Administration,
hington, D.C. National Marine Water Quality

primary bibliographic entry see Field 05C.
-05332

Sources of Pollution

**LYSIS OF THE USE OF DISTORTED
RAULIC MODELS FOR DISPERSION STU-
S,**
ornia Univ., Berkeley. Dept. of Civil Engineer-
and Illinois Univ., Urbana. Dept. of Civil En-
ering.
primary bibliographic entry see Field 02E.

W71-04853

NUTRIENTS IN STREAMS DRAINING WOODLAND AND FARMLAND NEAR COSHOCTON, OHIO,
Agricultural Research Service, Beltsville, Md. Soils Lab.
A. W. Taylor, W. M. Edwards, and E. C. Simpson.
Water Resources Research, Vol 7, No 1, p 81-89, February 1971. 9 p, 3 fig, 6 tab.

Descriptors: *Nutrients, *Runoff, *Forests, *Farms, *Ohio, Nitrogen, Nitrates, Phosphates, Potassium, Data collections, Water quality, Path of pollutants, Eutrophication, Appalachian Mountain Region, Farm wastes, Statistical methods, Fertilizers, Leaching, Water pollution sources.
Identifiers: Woodlands, Farm lands, Coshocton (Ohio).

Nitrogen, phosphate, and potassium concentrations were measured in streams draining woodland and farmland watersheds at Coshocton, Ohio 1966 through 1969. Temporal variations in the nutrient concentrations were much smaller than the changes in the rate of streamflow. No relationship was found between any nutrient concentration and streamflow, and no seasonal changes in concentration were detected. Nutrient losses from farmland were significantly greater than those from woodland. The nitrate-N concentration in the farm runoff was below 2 ppm except for one short period when it rose to 10 ppm. The input of nitrogen in the rain was greater than the loss in runoff from both watersheds. The average concentration of phosphate in runoff was 22 ppb (of P) from the farm and 15 ppb from the woodland. The analysis of the data shows that total nutrient losses cannot be calculated meaningfully unless both hydrologic and chemical data are available. The volume of water flow is the most important variable in this calculation. (Knapp-USGS)
W71-04856

MODEL OF HYDROLOGIC REDISTRIBUTION OF RADIONUCLIDES AROUND NUCLEAR-EXCAVATED SEA-LEVEL CANALS,
Isotopes, Inc., Palo Alto, Calif. Palo Alto Labs.
R. L. Charnell, D. E. Holly, and P. R. Fenske.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970; Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/51, p 801-814, 1970. 14 p, 5 fig, 14 ref. USAEC Contract AT (26-1)-171.

Descriptors: *Radioecology, *Fallout, *Leaching, *Path of pollutants, *Nuclear engineering, Nuclear explosions, Canals, Canal construction, Groundwater movement, Infiltration, Navigation, Seepage.
Identifiers: *Venezuela, *Nuclear canal excavation.

As part of the bioenvironmental and radiological-safety feasibility studies for nuclear excavation of a sea-level canal in Central America, a model was developed to estimate the rate at which excavation-produced radionuclides are redistributed by natural hydrologic processes. The model can be used to estimate the amount of a specific radionuclide available for interaction with plant, animal, or man. The model was formulated for two distinct regions: in the canal channel itself and the region away from the canal where dust and fine particles are deposited as wind-distributed fallout. For the fallout zone portion of the model, redistribution is controlled by the initial removal by rainwater leaching. The amount of radionuclide which is removed with rainfall is represented by the simple distribution coefficient Kd). Once the nuclide is dissolved, its rate of entry into the groundwater reservoir and into the stream can be determined from soil density and porosity, long-term infiltration rates, and some pre-excavation hydrologic data. This model was applied to two of the proposed canal sites in Panama and Colombia. For radionuclides with distribution coefficients higher than 100, concentration of the radionuclide in river water continues at a near constant level decreased only by radioactive decay. Removal from the land surface by leaching is not significant during the first year following excavation. On the other hand, for nuclides with distribution coefficients less than 100, leaching removal from the land surface is significant in one year and the concentration in streams drops rapidly. (Knapp-USGS)
W71-04882

DISTRIBUTION AND MIGRATION OF LEAD IN GROUND WATERS,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
G. A. Goleva, V. A. Polyakov, and T. P. Nechayeva.
Translated from Geokhimiya, No 3, p 344-357, 1970. Geochemistry International, Vol 7, No 2, p 256-268, 1970. 13 p, 4 fig, 5 tab, 18 ref.

Descriptors: *Water chemistry, *Leaching, *Heavy metals, Oxidation, Acid mine water, Sulfides, Sulfates, Ion transport, Mine water, Mine acids, Solubility, Water pollution sources, Path of pollutants, Solutes.
Identifiers: *Lead.

Anomalous lead contents in natural waters are related to oxidation of Pb-bearing sulfide deposits or leaching from rocks by chloride and bicarbonate waters. Maximum lead contents of 3-5 mg/liter are found in mine waters on deep-seated thermal fluids. In solution Pb forms important complex ions with each of the principal anions in natural waters. Migration of lead is limited in sulfate solutions by the low solubility of sulfate compounds, and in alkaline waters by precipitation of Pb (OH)2. Lead forms a number of stable metal-organic complexes, and is readily sorbed from solution as positively charged complexes. Hydrochemical lead anomalies are restricted and are among the best indicators of sulfide ore deposits. (Knapp-USGS)
W71-04894

BIOGEOCHEMICAL INVESTIGATIONS IN THE RUDNYY ALTAY,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.
For primary bibliographic entry see Field 02K.
W71-04895

EFFECTS OF MANURE DEPTH ON RUNOFF FROM SOUTHWESTERN CATTLE FEEDLOTS,
Texas Tech Univ., Lubbock.
L. L. Keeton, W. Grub, D. M. Wells, G. F. Meenaghan, and R. C. Albin.
Paper presented at the 1970 winter meeting American Society Agricultural Engineers, Chicago, December 8-11, 1970, Paper No 70-910. 7 p, 2 tab, 1 ref.

Descriptors: *Rainfall intensity, *Rainfall-runoff relationships, Farm wastes, Pollutants, Moisture content, Biochemical oxygen demand, Chemical oxygen demand, Waste water treatment, Water pollution sources.
Identifiers: Feedlot runoff, Feedlot slope, Water holding capacity.

With the increasing number of beef cattle in feedlots in the Southwestern United States has come a major water pollution problem. The effects of manure accumulation on quantity and quality of runoff from concrete and direct surfaced feedlots for various precipitation rates were determined. A relatively dry manure pack holds approximately one-half inch of rainfall per inch of manure depth. If runoff from a relatively dry mass occurs, large quantities of suspended and dissolved pollutants are carried off. Manure at 60 percent moisture minimizes the pollutants removed during feedlot runoff. The quality of feedlot runoff is primarily a function of the moisture content of the manure, the rainfall intensity, and the feedlot slope. (Christenbury-Iowa State)
W71-04913

CATTLE WASTES - POLLUTION AND POTENTIAL TREATMENT,
Kansas Univ., Lawrence. Dept. of Civil Engineering; and Kansas Univ., Lawrence. Environmental Health Engineering Lab.
For primary bibliographic entry see Field 05D.
W71-04916

WATER QUALITY CHARACTERISTICS OF THE NEW HOPE AND LOWER HAW RIVERS JULY 1966 - FEB. 1970 WITH ESTIMATES OF THE PROBABLE QUALITY OF NEW HOPE LAKE,
North Carolina Water Resources Research Inst., Raleigh; and North Carolina Univ., Chapel Hill. Dept. of Environmental Biology.
Charles M. Weiss.
Available from NTIS as PB-197 720, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute Report No. 48, January 1971. 139 p, 5 tab, 24 fig, 23 ref, 4 append. OWRR Project B-007-NC (2).

Descriptors: *Eutrophication, *Limnology, Waste assimilative capacity, Hydrogen ion concentration, *Water pollution effects, *Water quality, North Carolina, *Water pollution sources, Lakes, Oxygen requirements, Oxygen demand, *Sampling, Temperature, Turbidity, Conductivity, Dissolved oxygen, Nitrogen, Phosphorous, Chlorophyll, Biochemical oxygen demand.
Identifiers: New Hope Reservoir, New Hope River, Haw River, Oxygen balance, Waste water loading, Residues, Oxygen saturation, Index organisms.

The water quality characteristics of the lower Haw River (Saxapahaw to the juncture with the New Hope River) and the New Hope River (downstream of Chapel Hill and Durham) have been evaluated on the basis of 19 water quality parameters. The stations on the New Hope River were sampled in the period July 1966 - February 1970 and the Haw River from December 1967 to February 1970. Projections, based on the estimates of the quality of the two river systems have been made of the probable water quality that might be expected in the New Hope Lake. Although water quality degrading materials transported by the Haw River are greater by factors of 5 to 7 times that of the New Hope, the oxygen balance in the Haw River at the location of the new lake indicates that the upstream contributions of oxygen consuming materials have been essentially stabilized and the oxygen resources of the Haw River are near normal. In contrast, although the New Hope River transports a substantially smaller pollution load in terms of quality degrading materials per unit of time, oxygen assets have not recovered to the same extent as in the Haw. Due to longer detention times, it is estimated that the overall quality of the waters in the new impoundment will be controlled primarily from pollution from the New Hope drainage. (Howells-North Carolina)
W71-04932

ESTIMATING POPULATION EXPOSURE TO SELECTED METALS - MANGANESE,
Research Triangle Inst., Durham, N.C.
W. Kenneth Poole, and Donald R. Johnston.
Available from NTIS as PB-195 834, $3.00 in paper copy, $0.95 in microfiche. Report No NIH-ES-2433, Oct 1969. 165 p, 10 fig, 46 tab, 85 ref. Contract No PH-86-65-109.
Identifiers: *Public health, *Manganese, *Air pollution, Manganese, *Food contamination, *Water pollution, *Occupational diseases, Industrial wastes, Bibliographies, Reviews, Electric batteries, Manganese modules, Metalliferous minerals, Mining, Metal working, Dry cells, Welding rods, Agricultural wastes, Exposure, Steel industry, Manganese steels.

The report is intended to cover the following aspects of manganese in the environment: the flow of manganese from the time it is mined or imported until it is consumed; the 'exposure' of sub-populations occupationally exposed to manganese (i. e., persons handling manganese in one or more of its forms); and the 'exposure' of the general population to manganese via air, food, water, or otherwise. It also includes selected abstracts on chronic poisoning, occupational exposure and biological effects.
W71-04947

ESTIMATING POPULATION EXPOSURE TO SELECTED METALS - TITANIUM,
Research Triangle Inst., Durham, N.C.
W. Kenneth Poole, and Donald R. Johnston.
Available from NTIS as PB-195 819, $3.00 in paper copy, $0.95 in microfiche. Report No NIH-ES-2434, March 1969. 101 p, 8 fig, 23 tab, 50 ref. Contract No PH-86-65-109.
Identifiers: *Titanium, *Public health, *Food contamination, Titanium, *Industrial medicine, *Air pollution, *Water pollution, Exposure, Toxicity, Rutile, Mining, Pigments, Welding rods, Titanium alloys, Titanium dioxide, Metal working, Environmental surveys, Lung.

The report is intended to cover the flow of titanium from the time it is mined until it is consumed; the exposure of sub-populations occupationally exposed to titanium; and the exposure of the general population to titanium via air, food and water. Occupational exposure to titanium in the air has been found to be virtually absent. Apart from open pit operation, the mining industry has no significant exposure problem. Among manufactureres using titanium concentrates, pigment plants and titanium metal plants have been suggested as sources of possible excessive exposure. Food appears to be the most significant source of titanium exposure to the general population. Estimated daily titanium dose from a typical diet is 607microgram. Normal water intake is 3 microgram.
W71-04948

PARTICULATE ORGANIC MATTER IN KANEOHE BAY, OAHU, HAWAII,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 02L.
W71-04949

STATUS OF SALT-WATER ENCROACHMENT IN 1969 IN SOUTHERN NASSAU AND SOUTHEASTERN QUEENS COUNTIES, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 02L.
W71-04976

VERTICAL MOLECULAR DIFFUSION OF XENON-133 GAS AFTER INJECTION UNDERGROUND,
Geological Survey, Idaho Falls, Idaho.
John B. Robertson.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D287-D300, 1970. 14 p, 8 fig, 2 tab, 10 ref.

Descriptors: *Diffusion, *Path of pollutants, *Nuclear wastes, *Tracers, *Radioactivity techniques, Aquifers, Idaho, Distribution patterns, Injection wells, Waste disposal, Radioactive wastes, Playas.
Identifiers: Gas diffusion, Xenon radioisotopes, *Waste disposal wells.

Nine hundred and eighty-seven curies of radioactive Xe-133 gas mixed with 28,300 cu m of air was injected rapidly into permeable basalt strata at the National Reactor Testing Station, Idaho. A capping layer of fine-grained playa sediments confined the gas underground. The subsurface Xe-133 was monitored by Geiger-Mueller detectors and by air samples from observation wells surrounding the injection well. Most of the Xe-133 apparently remained underground and decayed radioactively. Molecular diffusion rates of Xe-133 from the ground were estimated using a simplified mathematical model. A maximum flux rate of 2,
microcuries/hr from a ground-atmosphere ir
face area of 26,700 sq m was calculated for the
day after injection. The estimated rates indicat
total diffusion loss of 0.37 c for the total area
ing the 26-day observation period. The calcul
rates had fairly good agreement with the meas
flux rates at the ground surface. Erratic variat
in the measured flux rates were attributed to o
influences such as barometric-pressure chan
(Knapp-USGS)
W71-04977

MIGRATION OF POLLUTANTS IN A GLAC OUTWASH ENVIRONMENT,
Washington State Univ., Pullman.
James W. Crosby, III, Donald L. Johnstone, and
Robert L. Fenton.
Water Resources Research, Vol 7, No 1, p 2
208, February 1971. 5 p, 5 fig, 11 ref. OWRR
ject B-005-WASH (3).

Descriptors: *Path of pollutants, *Glacial d
*Farm wastes, *Confinement pens, Colifor
Nitrates, Nutrients, Solutes, Soil water movem
Groundwater, Washington, Water pollu
sources, Chlorides, Soil moisture.
Identifiers: FeedlotsCattle), Outwash (Glacial).

A test drilling program was conducted at a dair
the Spokane Valley, Washington, to determine
effects of feedlot operation on groundwater qu
ty. Coliform bacteria, enterococci, and fe
coliforms were found to disappear within a relati
ly few feet of the ground surface. Chlorides
nitrates, however, were persistent in depth and
actually reach the groundwater body. The
natural moisture content of the soil, coupled w
the apparent high moisture tensions, suggests t
soil moisture is not presently moving downward
the system. It is concluded that the downw
migration of inorganic chemicals from the feed
environment must represent an early phase of
operation, which is arrested as organic mattes
formed in near-surface layers. (Knapp-USGS)
W71-05046

HYDROLOGIC IMPLICATIONS OF SOL WASTE DISPOSAL,
Geological Survey, Washington, D.C.
William J. Schneider.
Free on application to the US Geological Surv
Wash, DC 20242. Geological Survey Circular 6
F, 1970. 10 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Water pollution sources, *Urbani
tion, *Solid wastes, *Waste disposal, Surfa
wasters, Groundwater, Garbage dumps, Landfi
Waste dumps, Water pollution, Precipitation (A
mospheric), Seepage, Infiltration, Groundwa
movement, Hydraulics, Surface runoff, Strean
Soil types, Permeability, Floods, Evaluatio
Planning.
Identifiers: *Urban hydrology.

The disposal of more than 1,400 million pounds
solid wastes in the United States each day is a maj
problem. Four disposal methods-open dumps, sa
tary landfill, incineration, and onsite disposal-ca
an inherent potential for pollution of wat
resources. Seepage of rainwater through the wast
leaches undesirable constituents which reach t
groundwater in the area. This leachate is genera
both biologically and chemically contaminate
Pollution potential is highest in permeable are
with a shallow water table where the wastes are
direct contact with the groundwater. Site selecti
for disposal of solid wastes must be based
adequate water-resources information if poll
tional potential is to be minimized. This will requi
regional as well as localized data on the wat
resources of the area. Only through such an a
proach can adequate protection be afforded to t
environment in general and the water resources
particular. (Woodard-USGS)
W71-05094

TEST SIMULATION OF THE TEMPERA-
URES OF THE DEERFIELD RIVER,
ttelle Memorial Inst., Richland, Wash. Pacific
orthwest Lab.
T. Jaske.
SAEC Contract at (45-1)-1830. AEC Research
d Development, Report No BNWL-628, UC-80,
c 1967. 41 p, 9 fig, 3 tab, 6 ref.

escriptors: *Thermal pollution, *Temperature,
recasting, Density, Flow profiles, Meteorological
a, Massachusetts, Water pollution sources.
ntifiers: *Deerfield River, COL HEAT simula-
n system, Thermal discharge, Advected heat,
avel time, Currents.

o test simulations involving adaptation of the
ital simulation system were performed using ac-
l data collected in two sidely differing drainage
ins. The report summarizes the results of the
erfield simulation. It uses temperature records
lected by the New England Power Company
ing the period of 1960 through 1963. It is con-
ded that the COL HEAT simulation system is
erally adequate to represent the water tempera-
e regime of the Deerfield River within the accu-
y of the input data presented for evaluation. The
a required for operation of the temperature
del are water temperature at the inlet and outlet
, form of discharge at the outlet, meteorological
ameters, river or reservoir dimensions reduced
equivalent non-parallel trapezoidal cross sec-
s, and advected heat quantities. A hypothetical
mal discharge of 300 MW directly into the
r was performed as an exercise in predictive
ability of the model. The results indicate that
n 10 to 30 percent of this heat would remain
ng the summer months and 40 to 60 percent
ng the cooler months in the river at a station 27
s below the hypothetical discharge point. (U-
nyaya-Vanderbilt)
-05128

TED DISCHARGE FROM FLUME INTO
K,
nesota Univ., Minneapolis. St. Anthony Falls
raulic Lab.
z Stefan, and Frank R. Schiebe.
nal of the Sanitary Engineering Division,
eedings of ASCE, Vol 96, No SA6, Paper
, p 1415-1433, December 1970. 15 fig, 9 ref.

riptors: *Thermal stratification, *Impound-
s, *Outlets, *Dispersion, Water quality, Water
erature, Froude number, Reynolds number,
r pollution sources, Flumes.
ifiers: *Thermal discharges, Velocity distribu-
Tethered-sphere method.

mation obtained in laboratory experiments is
on the physical processes producing tempera-
nd velocity distributions when heated water is
arged from a channel into a wide, deep im-
dment. Both the outlet channel and the
ving tank in the experiments had rectangular
sections, but the tank was more than 10 times
and deeper than the channel. The tethered-
e method was developed to measure local
ities; local temperatures were also measured
surface spreading patterns were recorded
graphically. Investigated densimetric Froude
ers and Reynolds numbers at the outlet
d from 0.6 to 7.2 and from 1500 to 9600,
ctively. (Oleszkiewicz-Vanderbilt)
05132

E CHARACTERISTICS OF THE THER-
REGIME OF RIVERS IN THE DANUBE
DNIESTER BASINS,
nskii Nauchno-Issledovatelskii
meteorologicheskii Institut, Kiev (USSR).
imary bibliographic entry see Field 02E.
05141

CHENA RIVER, THE STUDY OF A SUB-
IC STREAM,
l Water Quality Administration, College,
. Alaska Water Lab.
Paul J. Frey, Ernst W. Mueller, and Edward C. Berry.
Available from NTIS as PB-197 857, $3.00 in paper copy, $0.95 in microfiche. October 1970. 96 p, 14 fig, 26 tab, 57 ref. FWQA Project No 1610--10/70.

Descriptors: Benthos, Chemical oxygen demand, Coliform, *Dissolved oxygen, Diversification, Fisheries, *Flood control, Freezing, Nutrients, Plankton, Water pollution sources, Reaeration, Sewage, Temperature, *Water quality, Water pollution effects, *Alaska, Subarctic, Flow.
Identifiers: *Chena River (Alas), Fairbanks (Alas), Break-ups, *Subarctic streams.

The Chena River is a subarctic stream flowing westerly from the low mountains of eastern Alaska to the Tanana River near Fairbanks. It is typical of many Interior Alaska rivers with the exception that its lower reaches are highly polluted by domestic and industrial wastes from the Fairbanks area. The purpose of this 3-year study of the river was to understand the physical, chemical, and biological limnology of the river system and what effect man's influence--past, present and future--has on the river. Dissolved oxygen was one of the most critical parameters determined. In the summer it is close to saturation. During winter, in the lower river, the concentration approaches 1 mg/1. The biological community was studied through both quantitative and qualitative plant and animal collections. The upper reaches of the river are much richer in number of kinds of organisms than the lower reaches. Coliform bacteria counts range from very low in the upper river to over 500,000 per 100/ml below Fairbanks. A flood control dam is planned for the river above the city of Fairbanks. Significant modification of the water quality and biota of the river can be expected following the construction of the dam. Proper management of the flow from the impoundment can reduce the objectionable effects of this dam on the river system.
W71-05143

OCEANOGRAPHIC OBSERVATIONS OF OIL SLICKS DURING THE CHEVRON SPILL, MARCH, 1970,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Stephen P. Murray, William G. Smith, and Choule J. Sonu.
Available from NTIS as AD-714 260, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 87, Sept 1970. 106 p, 34 fig, 6 tab, 37 ref. ONR Project NR-388002.
Identifiers: *Water pollution, *Oils, *Estuaries, *Mexico Gulf, Water pollution, Wind, Water waves, Interactions, Tides, Seacoast, Temperature, Salinity, Deltas, Density, Predictions, Data processing systems, Diffusion, Statistical data, Petroleum, Mississippi, Petroleum industry, *Oil slicks, *Oil pollution, Mississippi River, *Oil wells, Blowouts, Oceanographic data.

Oceanographic observations near the Chevron spilling well off the Mississippi Delta in March 1970, revealed relative roles of various physical factors of the regional estuarine system in the behavior of oil slicks. Surface stress from the wind was most important; at speeds above 15 mph the slick orientation was generally determined by the wind direction. The wind also indirectly affected oil which was sunk by dispersant in that wind waves promoted mixing, which in turn affected the vertical stability, hence eventually the velocity profile. Wind setups and setdowns were correlated with downward and upward isopycnal movements, respectively. Both calculations and observations showed that tidal currents produced an L-shaped slick geometry when winds were below about 15 mph. The diurnal rotation of the tidal currents served to limit the excursion length of oil from the source, keeping it short of the nearest shore. The presence of fresh water from the Mississippi River in the surface layer and the consequent development of convergence lines often formed a natural barrier, preventing oil from encroaching upon the shore. Theoretical analysis using turbulent diffusion theory disclosed that the area and length of a steady-state oil slick increased with oil discharge but decreased with current speed and the lateral diffusion coefficient.
W71-05148

INDUSTRIAL USE OF SURFACE WATERS IN ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 03E.
W71-05166

BIOMONITORING OF INDUSTRIAL EFFLUENTS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Herbert W. Jackson, and William A. Brungs, Jr.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, March 1966, p 117-124. 2 fig, 13 ref.

Descriptors: *Biota, *Industrial wastes, *Effluents, Aquatic life, *Toxicity, Biology, Microbiology, Water pollution sources.
Identifiers: *Biomonitoring, Aquarium.

This system allows for continuous surveillance over the toxicity of an effluent and has the following objectives: (1) to demonstrate the continuous suitability of an effluent for aquatic life provided slow-acting or cumulative toxins are not involved; (2) to detect change in the biological acceptability of the effluent itself; and (3) to detect change in the effect of effluent on the biota of the receiving waters. Objective 1 can be accomplished through the use of an aquarium but objectives 2 and 3 are considerably more difficult. A single basic design of exposure tanks and a flow plan are presented as a means to accomplish objectives 2 and 3. Effluent supply, dilution water, proportioning of flow and test animals are discussed to enhance the ideas presented. (Ellis-Texas)
W71-05170

PROCEEDINGS, CONFERENCE ON HAZARDOUS CARGOES, U. S. COAST GUARD ACADEMY, NEW LONDON, CONNECTICUT ON 8-9 JULY 1970.
National Research Council, Washington, D.C. Committee on Hazardous Materials.

Available from NTIS as PB-195 685, $3.00 in paper copy, $0.95 in microfiche. August 1970. 251 p.
Identifiers: *Hazardous materials, Meetings, *Cargo transportation, Hazardous materials, *Information systems, Cargo ships, Petroleum, Pesticides, Chemical reactions, Information centers, Public health, Chemical industry, Transportation.

Contents: Cargo mixing possibilities and preventive measures; Problems and preventive measures of chemical reactions as seen by the engineering, supervisory, and operating teams in the chemical industry; Classification of reactive chemicals; Evaluation of chemical stability; Chemical industry transportation emergency information systems; A pesticide safety team network program; The operation of a specialized scientific information and data analysis center with computerized storage and associated transmission network; The DOT casualty reporting system; Proposed special topics program as related to hazardous materials in the Coast Guard Academy curriculum; Casualty review and analysis in the Coast Guard; A maritime safety management information system; The Coast Guard program for an information system on hazardous materials; Prospects for a national information system for hazardous materials.
W71-05260

TRANSPORT ANALYSIS-BASIC PREDICTIVE APPROACH OF THE MOVEMENT OF POLLUTANTS THROUGH SOIL,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
D. B. Cearlock.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 516-526, March 1966. 5 fig, 8 ref. US Atomic Energy Commission Contract AT (45-1)-1830.

Descriptors: *Soil water movement, Diffusion, Darcy's Law, Dispersion, Convection, Biological, Chemical, Physical, *Path of pollutant, Water pollution sources.
Identifiers: *Transport analysis, Macroscopic, Miscroscopic.

To insure applicability of one-dimensional laboratory investigations to multi-dimensional field problems, two phenomena, fluid movement and pollutant reactions, were investigated separately and equations were developed to predict pollutant transport through soil. The fluid movement component of the transport equation groups together all mechanisms that transport the pollutants such as convection, diffusion, and dispersion. The reaction component includes all reactions that occur between the pollutant and its environment such as biological, chemical, and physical aspects. (Ellis-Texas)
W71-05264

SUMMARY OF OUR PRESENT KNOWLEDGE OF THE PHYSICAL PROCESSES OF MIXING IN THE OCEAN AND COASTAL WATERS, AND A SET OF PRACTICAL GUIDELINES FOR THE APPLICATION OF EXISTING DIFFUSION EQUATIONS IN THE PREPARATION OF NUCLEAR SAFETY EVALUATIONS,
Atomic Energy Commission, Washington, D.C., AND Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Institute.
For primary bibliographic entry see Field 02L.
W71-05324

5C. Effects of Pollution

EUTROPHICATION,
Wisconsin Univ., Madison. Water Resources Cneter.
G. Fred Lee.
Available from Ntis as PB-197 697, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Univ, Madison, Water Resources Center, Eutrophication Information Program Occasional Paper No 2, 1970. 39 p, 1 fig, 2 tab, 37 ref. OWRR Project W-117 (No 1614) (2).

Descriptors: *Eutrophication, *Lakes, *Water pollution sources, *Water pollution control, Water quality, Pollution abatement, Nutrients, Phosphorus, Nitrogen, Classification, Measurement, Trophic level.
Identifiers: Eutrophication classification, Eutrophication measurement, Lake classification.

The eutrophication process is described giving lake characteristics and classification. Causes of eutrophication are discussed, including factors influencing aquatic plant production, types of aquatic plant nutrients, together with concentration and sources of nitrogen and phosphorus, which include domestic and industrial waste waters, urban and agricultural drainage and natural sources; the role of lake sediments, atmospheric sources, groundwaters, marshes, and nitrogen fixing bacteria and their interaction with nitrogen and phosphorus sources are outlined. The parameters to be considered in measurement of eutrophication are evaluated. Effect of eutrophication on domestic, industrial, and recreational uses of water are outlined. A summary of methods used in reducing and controlling effects and rate of eutrophication includes nutrient removal from waste waters, waste water diversion, dredging, flushing, chemical and biological control of nuisance plant growth, harvesting, lake aeration, control of agricultural sources of nutrients and control of urban drainage, hypolimnetic withdrawal, water level management, and immobilization of nutrients. (Auen-Wisconsin)
W71-04909

AIR POLLUTANTS AFFECTING THE PERFORMANCE OF DOMESTIC ANIMALS - A LITERATURE REVIEW.
Agriculture Research Service, Washington, D.C.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $1.00. Agriculture Handbook No 380, Issued August 1970. 109 p, 666 ref.

Descriptors: *Domestic animals, *Air pollution effects, *Toxicity, Pollutant identification, Air pollution, Atmsophere, Smoke, Pollutants, Physiological Ecology, Legislation, Farm wastes, Laboratory studies, *Reviews, *Bibliographies, Water pollution effects.
Identifiers: Inhalation, Ingestion, Veterinary diagonosis, Esthetic effects, Automobile exhausts.

The results of a Literature Survey to determine the effects of air pollution on domestic animals is presented. The term 'domestic animals' as used in this report includes cattle, sheep, goats, swine, horses, chickens, turkeys, ducks, geese, pigeons, Japanese quail, dogs, cats, rabbits, and honey bees. Chapters 2, 3, and 4 on air pollution, smoke, and automobile exhausts provide a brief background on the generalities of these pollutants and their effects on domestic animals. Many of the specific air pollutants found in the air, smoke, and automobile exhausts are described in subsequent chapters, which contain a brief introduction of the air pollutant, the published results, a summary, and a bibliography. (Christenbury-Iowa State)
W71-04910

BOVINE SALMONELLOSIS (S. TYHIMURIUM) IN A FEEDLOT OPERATION,
For primary bibliographic entry see Field 05F.
W71-04918

BOVINE SALMONELLOSIS ASSOCIATED WITH CONTAMINATED CREEK WATER AND HUMAN INFECTION,
Kansas State Univ., Manhatton. Coll. of Veterinary Medicine.
For primary bibliographic entry see Field 05F.
W71-04919

OBSERVATIONS ON THE EFFECT OF THE RE-USE OF BROILER LITTER ON THE INCIDENCE OF MAREK'S DISEASE,
Delaware Univ., Newark.
G. W. Chaloupka, R. W. Lloyd, J. F. Gordy, and L. M. Greene.
Poultry Science, Vol 47, p 1660, 1968.

Descriptors: *Farm wastes, *Condemnation, *Poultry, *Disinfection, Public health, Pollution abatement, *Diseases.
Identifiers: *Marek's disease, Broiler house, Litter re-use, Leucosis, Immunity, Causative agent.

Four different studies involving several trials have been conducted at the University of Delaware Substation in which the performance of broilers grown on re-used litter was compared to those grown on new litter. These studies over a period of several years have shown that broiler condemnations due to leucosis have in most instances been lower for the broilers grown on re-used litter. This substantiates the findings of many field studies and by at least one private research farm. These results would indicate that a failure to clean out and disinfect the broiler house before placing each new lot of chicks is not a primary factor in increasing the incidence of Marek's disease. It is not known whether these results are due to developing a partial immunity due to contact with the caus agent in the litter at an early age, or whethe causative agent is destroyed in some way ir reused litter. (White-Iowa State)
W71-04927

WATER QUALITY CHARACTERISTICS THE NEW HOPE AND LOWER HAW RIV JULY 1966 - FEB. 1970 WITH ESTIMATE THE PROBABLE QUALITY OF NEW H LAKE,
North Carolina Water Resources Research Raleigh; and North Carolina Univ., Chapel Dept. of Environmental Biology.
For primary bibliographic entry see Field 05B.
W71-04932

BIOLOGICAL PRODUCTIVITY OF COEUR d'ALENE RIVER AS RELATED WATER QUALITY, (THE ACUTE TOXIC OF ZINC TO CUTTHROAT TROUT-SAL CLARKI),
Idaho Univ., Moscow. Dept. of Biological Scie and Idaho Univ., Moscow. Water Resou Research Inst.
F. W. Rabe, and C. W. Sappington.
Available from NTIS as PB-197 736, $3.0 paper copy, $0.95 in microfiche. Idaho W Resource Research Institute, Completion Re December 1970. 16 p, 1 tab, 24 ref. OWRR Pr A-024-IDA (1).

Descriptors: *Bioassay, *Zinc, *Cutthroat t Limnology, Water quality, *Toxicity, Id Productivity, Lethal limit, Water pollution eff Industrial wastes.
Identifiers: Salmo clarki, Coeur d'Alene River.

Determinations of the acute toxicity of zin Cutthroat trout (Salmo clarki) fingerlings conducted using two bioassay systems. M orange alkalinity of the test water was 23.9 pp calcium carbonate. PH values were near neutr In a standard, static bioassay, 24, 48 and 9 median tolerance limit (TLm) values of 0.62, and 0.09 ppm zinc respectively, were obtai Results of a recirculating, flowing-water bioa showed a 24 hr TLm value of 0.42 ppm zinc. N or 96 hr values were found due to statistical significance of the data. The inconclusivenes the results of the running system may be du changes in the concentration of zinc present ir test water as a result of sorption of the zinc io the bottom and sides of the test tank. (Rabe-Ida
W71-04939

ECOLOGICAL DISTRIBUTION OF PE CIDES IN LAKE POINSETT, SOUTH DAKO
South Dakota Agricultural Experiment Sta Brookings; and Cooperative Fishery U Brookings; and South Dakota State U Brookings. Dept. of Biochemistry.
Michael R. Hannon, Yvonne A. Greichus, Rich L. Applegate, and Alfred C. Fox.
Transactions of the American Fisheries Soc Vol 99, No 3, p 496-500, 1970. 4 tab, 16 ref.

Descriptors: *Water pollution effects, *Water lution sources, *Chlorinated hydrocarbon p cide, Distribution, Bottom sediments, Aqu habitats, Aquatic animals, Aquatic plants, D Ecosystems, Chromotography, Pesticides, Tro level, South Dakota.
Identifiers: Lake Poinsett (S.D.), Pesti residues, DDD, DDE.

The distribution was studied of residues chlorinated hydrocarbons in relation to diffe ecosystemic components: water, bottom sedime zooplankton, benthic algae, crayfish, insects, fish. The residues of DDT and its metabolites D and DDE were the highest in all trophic le Heptachlor, heptachlor epoxide, aldrin, diel and lindane were present in the majority of s pled types, and toxaphene in fish. Neither en nor metoxychlor was detected. Water had a

ow concentration of residues. In comparison with water the concentration of residues was as follows: ottom sediments and crayfish--18 times higher, ooplankton and benthic algae--37 times, fish--790 imes, and aquatic insects--7300 times. No signifi-ant difference was found by analysis of variance etween fall and spring samplings. (Wilde-Wiscon-in)
V71-04958

HE EFFECT OF VARYING AMOUNTS AND RATIOS OF NITROGEN AND PHOSPHATES ON ALGAE BLOOMS,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
Ruth Patrick.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, March 1966, p 41-51. 6 tab, 6 ref.

Descriptors: *Nitrogen, *Phosphates, *Algae, Eutrophication, Diatoms, Microbiology, Nitrates, Ammonia, Water pollution effects, Waste water treatment, Pennsylvania.
Identifiers: *Glucose, Waterloo Mills (Pa).

A series of experiments was undertaken at the Waterloo Mills Field Research Station to try to determine the effect of nitrogen as nitrates or ammonium and phosphates in varying amounts and ratios on natural communities of diatoms. Some experiments were carried out to determine the effects of adding small amounts of glucose to these enriched waters. Certain species increased in abundance with increases in nitrogen as nitrates and/or a ammonium and with increases in phosphates and some of them with the addition of small amounts of glucose. However, the heavy diatom growths which often occur in streams enriched with effluents from sewage treatment plants did not occur which indicates other factors are important to the growth of diatoms and hence, algal blooms. (Ellis-Texas)
W71-05026

HE EFFECT OF NITRIFICATION OF ORGANIC WASTES ON WATERS IN THE NATURAL ENVIRONMENT-I. EFFECTS OF SEED,
Maine Univ., Orono. Dept. of Civil Engineering.
Harry A. Patrie, K. Keshavan, and Franklin E. Goodard.
Proceedings Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 869-879, March 1966. 4 fig, 6 tab, 13 ref.

Descriptors: *Nitrification, *Nitrates, Dissolved oxygen, Oxygenation, Deoxygenation, Bacteria, Organic wastes, Water pollution effects, Waste water treatment, *Biochemical oxygen demand.
Identifiers: *Nitrogeneous BOD, *Carbonaceous BOD, *Nitrifiers, Seed, Assimilation capacities, Examination, Deoxygenation, Synthetic waste.

The standard five-day BOD test is questioned as to its reliability in simulating stream conditions. It was previously supposed that BOD progression always allowed two distinct steps, the carbonaceous and then the nitrogenous. Observations of stream conditions and laboratory experiments showed that when active nitrifiers are present initially in sufficient numbers, both the carbonaceous and the nitrogenous demand are exerted simultaneously, and the oxygen uptake becomes nearly exponential. Comparisons between raw sewage and synthetic sewage, part seeded with nitrifying bacteria, and part unseeded were made. Average BOD exertion was 11% higher in the seeded bottles than the unseeded one, and nitrate production ranged as much as 3120% higher in seeded samples than in unseeded samples. These results showed that nitrification was not suppressed by carbonaceous oxidation when sufficient active nitrifiers were present, and that this nitrification was a significant factor in the oxygen depletion of the sample. Therefore, it is imperative that a proper bacterial seed must be selected for the BOD test to avoid serious discrepancy between predicted and actual dissolved oxygen levels in a natural body of water. (Lowry-Texas)
W71-05033

LAKES--RESTORATION AND PRESERVATION,
Federal Water Quality Administration, Cincinnati, Ohio. Field Investigations Branch.
Lowell E. Keup, and Kenneth M. Mackenthun.
Water and Sewage Works, 1970 Reference Number, Vol 117, p R16-R21, November 28, 1970. 6 p, 2 tab, 18 ref.

Descriptors: *Lakes, *Eutrophication, *Aquatic weed control, *Ecology, *Water quality, Preservation, Control, Limnology, Surface waters, Environmental effects, Self-purification, Lake soils, Sedimentation, Methodology, Nutrients, Water pollution, Streamflow, Runoff, Biological treatment, Wastes, Sewage.
Identifiers: *Lake preservation, Plant ecology.

Problems concerned with lake eutrophy and methods of lake restoration and preservation are discussed. The ultimate end of eutrophy is the elimination of a lake or reservoir. Before this end is reached, a number of undesirable conditions develop that are frequently due to increased biological production in the lake. For example, larger standing crops of algae and pond weeds produce undesirable tastes and odors in water to interfere with public supplies and to increase solids that must be removed. When the plant life dies it contributes to deoxygenation, a problem particularly significant in deep waters of stratified lakes where anaerobisis induces increased sulfide, iron and manganese concentrations. Each lake must be examined before its problem can be assessed and preventive measures initiated to check eutrophy. The nutrient that offers the best chance for control with the least side-effects appears to be phosphorus. It can be removed from waste waters with 99 plus percent efficiency by precipitating calcium (lime), iron, aluminum (alum) or copper ions. (Woodard-USGS)
W71-05082

EFFECT OF HANFORD PLANT OPERATIONS ON THE TEMPERATURE OF THE COLUMBIA RIVER, 1964 TO PRESENT,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
R. T. Jaske, and M. O. Synoground.
AEC Research and Development Report, BNWL-1345, UC-70, Nov 1970. 259 p, 48 fig, 38 tab, 79 ref.

Descriptors: Temperature, Forecasting, Least squares method, Reservoirs, Ecology, Computer programs, Instrumentation, Mixing, Radioisotopes, Columbia River, Washington, Oregon, Water pollution effects.
Identifiers: Hanford Plant (Wash).

This study is primarily concerned with the changes in temperature in the Columbia River as a result of dam construction and the Hanford works. Routine radiological aspects are not included. The data was analyzed by means of a nonlinear, maximum likelihood, least squares fit, routine capable of handling non-linearity and saddlepoints reliably. It is concluded that the erection of hydraulic power dams and reservoirs on the Columbia River has had only a minimal effect on the annual mean temperature of the entire system. Studies of the thermal dissipation of reactor effluent indicate that a majority of the heat is dissipated before the confluence of the Snake and the Columbia. Detailed measurements in the Hanford plant effluent mixing zone are described. Concentrations of radionuclides in invertebrate organisms of the river decreased by one or two orders of magnitude during a plant shutdown. A number of reports directly related to this program are itemized in a section of this report. (Upadhyaya-Vanderbilt)
W71-05116

A SURVEY OF CALIFORNIA COASTAL POWER PLANTS,
Federal Water Pollution Control Administration, Portland, Oreg.
For primary bibliographic entry see Field 05G.
W71-05118

EFFECTS OF THERMAL DISCHARGES ON THE MASS ENERGY BALANCE OF LAKE MICHIGAN,
Argonne National Lab., Ill.
J. G. Asbury.
July 1970. 24 p, 27 ref. ANL/ES-1.

Descriptors: *Thermal pollution, *Temperature, Evaporation, *Lake Michigan, *Energy budget, Water balance, Water pollution effects, Lakes.
Identifiers: Thermal discharges, Wind speeds, Exchange coefficients, Advective input.

This report analyzes the impact of man-made thermal discharges on the mass-energy balance of Lake Michigan. The analytical method used is a generalized version of the heat-exchange model developed by Edinger and Geyer for small lakes and cooling ponds. The generalized model should be applicable to large bodies of water. Land-based meteorological data input to the model are corrected for systematic lake-land variation. The lake-wide physical effects of thermal discharges into Lake Michigan are negligible and will continue to be so for the rest of this century. The calculated annual average increase in Lake Michigan water-surface temperature is 1.4..0.4x10 to the minus 3 F per gigawatt of advective input. The associated increase in evaporation water loss is 9..2 cfs per gigawatt input. The model has also been applied to Lake Superior, Horon, Erie, and Ontario. For each of these lakes, the increases in surface temperature are of the same order as for Lake Michigan. (Upadhyaya-Vanderbilt)
W71-05119

AIRBORNE TEMPERATURE SURVEYS OF LAKE MICHIGAN, OCTOBER, 1966 AND 1967,
Michigan Univ., Ann Arbor. Great Lakes Research Div; and Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-05120

MAXIMUM ALLOWABLE CONCENTRATIONS OF MERCURY COMPOUNDS.
Karolinska Institutet, Stockholm (Sweden).

Arch Environ Health, Vol 19, Dec, 1969, p 891-905. 99 ref.

Descriptors: Metals, *Heavy metals, *Toxicity, Standards, Water pollution effects, Human pathology, Epidemiology, Path of pollutants, Diseases, Air pollution.
Identifiers: Maximum allowable concentrations, Human contamination, *Mercury, Mercury pollution.

The report of an International Committee is presented. Permissible limits for mercury are not the same in different countries. They are 0.1 mg/cu m for metallic vapor and inorganic compounds and 0.01 mg/cu m for organic mercury compounds in USA while in USSR, the permissible limits have been stated to be 0.01 mg/cu m for inorganic mercury and 0.005 mg/cu m for alkyl mercury compounds. The deposition of mercury compounds is stated. The article deals further with experimental aspects (absorption, biotransformation and transport, tissue distribution and retention, clinical aspects, chronic exposure, relation between exposure and symptoms, urine mercury, blood mercury, and biochemical changes as an indication of mercury exposure) of inorganic and organic mercury. The toxicity of particular compounds is variable and from this point of view the following categorization is recommended: (1) methyl and ethyl mercury salts, (2) mercury vapor, and (3) inorganic mercury salts. MAC for the three groups

are recommended to be: group (1) 10 microgram Hg/100 ml of blood, group (2) 0.05 mg/cu m, and group (3) 0.01 mg Hg/cu m. (Novotny-Vanderbilt)
W71-05122

CADMIUM POLLUTION IN PERSPECTIVE,
Institute of Public Health, Tokyo (Japan).
Noboru Yamagata, and Itsuzo Shigematsu.
International Symposium on Hydrogeochemistry and Biogeochemistry, September 7-12, 1970, Tokyo, Japan, Preprint. 39 p, 41 ref, 22 tab, 9 fig.

Descriptors: *Metals, Water pollution, *Diseases, Epidemiology, Water quality, Water properties, Water analysis, Polarographic analysis, Spectrophotometry, Toxicity, Human pathology, Water pollution effects, *Heavy metals.
Identifiers: *Cadmium pollution, Mines, Industrial lakes, Chemical vanes.

A brief history of scientific investigations since the manifestation of cadmium poisoning disease up to date is described. Background information on the geochemistry and analytical chemistry of cadmium and the results of surveillances conducted in several districts are given. Characteristic symptoms of 'itai-itai' are listed. Cadmium can be analytically measured by the emission spectrography, polarography, neutron activation analysis, colorimetry, atomic absorption spectrometry. The most sensitive is the atomic absorption. In Japan, it was estimated that man consumes normally 60 micrograms of cadmium/day but in the area of occurrence of 'itai-itai' disease the consumption was more than 600 micrograms/day. The main contributor of the cadmium is foodstuffs, of which above, a half is contributed by rice. (Novotny-Vanderbilt)
W71-05124

PUBLIC OPPOSITION TO NUCLEAR POWER - AN INDUSTRY OVERVIEW,
Atomic Industrial Forum, Inc., New York; and Niagra Mohawk Power Corp., Syracuse, N.Y.
H. G. Slater.
International Atomic Energy Agency Symposium on Environmental Aspects of Nuclear Power Stations, New York, Preprint SM-146/40, August 10-14, 1970, p 15.

Descriptors: *Nuclear powerplants, *Thermal pollution, Environment, Technology.
Identifiers: *Public opinion, Distrust, Polls, Opposition, Controversy.

The public is demonstrating an intense concern for its environment. Most polls on the subject also indicate that the public is by no means as opposed to nuclear power as some critics would have us believe. As recently as five years ago only eight nuclear power reactors had been built in the United States while today there are more than 100 in operation, under construction or on order, representing a total capital investment of $15 billion. Even if more of the public and the press begin recognizing the environment advantages of nuclear power, the controversy around this technology is not likely to disappear, or even diminish. In the press, in much conservationist literature, even in material from some government agencies, the words thermal pollution are invariably linked with the phrase nuclear power. All power plants contributed to the thermal load; present day nuclear plants about 1/3 more than fossil-fueled plants. A major factor in the criticism of the nuclear community is te public's general distrust of the establishment and its credibility. (Upadhyaya-Vanderbilt)
W71-05126

THERMAL WATER HORTICULTURAL DEMONSTRATION PROJECT,
Eugene Water and Electric Board, Oreg; and Vitro, Eugene, Oreg.
Dale E. Bartholomew, Robert W. Bennett, William L. Cole, Rex E. Heide, and James B. O'brien.
1969 Annual Report, February 1970, p 49. 43 fig, 21 tab, 13 ref.

Descriptors: *Thermal water, *Irrigation systems, *Crops, *Frost protection, Experimental farms, Meteorology, Temperature, Humidity, Weather data, Heated water, Water pollution effects.
Identifiers: *Plant cooling, O'brien Farm, Patrick Farm, Heide Farm, Puustinen Farm, Bartholomew/Cole Farm, Bennett Farm.

This project demonstrates how properly managed thermal water from an industrial source can be used advantageously for agricultural irrigation and then returned to its natural source at acceptable temperature levels. The effects of warm water application on crops and attempts to regulate their micro environment are being managed and demonstrated primarily on frost protection, plant cooling and irrigation. It is concluded that thermal energy in warm effluent water can be dissipated by spraying directly to the atmosphere in an agricultural setting. With this dissipation, there was negligible fogging or mist drift to nearby residential areas. Also, the artificially induced warm, moist microclimate on the project did not cause any increase in fungal bacterial problems nor increase the insect infestation. Accidental leaks in the system caused limited flooding of a small area with water at 125F to 130F. Ponding of waters at these temperatures is harmful to bean, peach, apple and nut crops. Soil heating was shown to be beneficial. (Herrera-Vanderbilt)
W71-05127

ENGINEERING SAFETY FACTORS AND THEIR INFLUENCE ON SITING PRACTICES FOR NUCLEAR POWER PLANTS IN THE EUROPEAN COMMUNITIES,
Council of the European Communities, Brussels (Belgium). Industrial Affairs.
W. F. Vinck, H. A. Maurer, and L. Leonardini.
The International Atomic Energy Agency Symposium on Environmental Aspects of Nuclear powerplants, New York, August 10-14, 1970, Typescript. 40 p, 4 tab.

Descriptors: *Sites, *Cooling water, *Safety, Standards, *Thermal pollution, Ecology, Temperature, Accidents, *Nuclear powerplants, Environmental effects.
Identifiers: Oxygen content, Pressure vessel, Core cooling systems, Europe.

The environmental aspects of nuclear powerplants are first of all determined by the conditions of the site, but also by the design and operational conditions of the plant. In general, a site is decided upon by the utility, economic incentives such as load centres and transmission lines and on the basis of technico-economical considerations such as long term provisions for cooling water. A tendency to set even more strict radiological standards, which can be debated, would not affect significantly the development of nuclear power but does also not add to the protection of the public in a significant manner. Recommendations that specify upper temperature limits as well as minimum oxygen content for discharged cooling water, differ from one country to the other within the European community because of differences in local environmental conditions and of incidental discrepencies in regulations. Within the European community, design and engineering for nuclear power comply with the particular site and environmental conditions with which one is confronted. (Upadhyaya-Vanderbilt)
W71-05129

WASTE HEAT AND THE WATER ENVIRONMENT,
Gulf South Research Inst., New Iberia, La.
Julian Hemens.
Chemical Engineering Progress, Symposium Series, Vol 65 (1968) No 97, p 47-50. 4 ref.

Descriptors: *Standards, *Fish, *Thermal pollution, Water quality, Temperature, Thermal power plants, Water pollution effects, Aquatic plants, Aquatic life, Cooling, Cooling water.
Identifiers: Thermal pollution effects, Temperature effects, *Waste heat.

A discussion on temperature standards is present in this paper. The influence of temperature chemical reactions taking place in waters can a determine the role of metabolism and activity of aquatic organisms. Most of the attention has be focused on sports and commercial fish. The medi tolerance value (TLm) of some species has be determined. The data on the other organisms th fish are not so detailed. Recommendation rega ing temperature restrictions is presented. Grow of some species can take place at temperatures high as 39C. Breeding seasons above 26.7C a likely to impair spawning and egg developme For most cold water species the requirement about 11C. (Novotny-Vanderbilt)
W71-05130

POWER STATION SITE SELECTION IN E GLAND AND WALES,
Central Electricity Generating Board, London (E gland).
F. R. Hunt.
International Atomic Energy Agency Symposiu on Environmental Aspects of Nuclear Pow Plants, New York, August 10-14, 1970. Prepri SM-146/35. 15 p, 4 fig.

Descriptors: *Thermal pollution, *Powerplant *Sites, *Cooling water, Radioisotopes, Economic Environment, Water pollution effects.
Identifiers: Gaseous wastes, Public opinion.

Over the 15 year period from 1961 to 197 generating plant capacity in England and Wal will have been increased from 27000 MW to 6700 MW. Probably the most difficult problems cu rently facing power station planners in England an Wales are the visual impact on nearby urban area of groups of cooling towers and the vapour plume emitted from them which can be persistent at time of high atmospheric humidity and the creation c confidence on the part of licensing authority an public in near urban siting of nuclear stations. Th main factors taken into account in the technica and economic evaluation of power station sites ar fuel supply and delivery, cooling water, site are levels and foundation conditions, transmissio lines, access for construction, ash disposal, aircra obstruction and nuclear safety. The biological an chemical consequences of discharging warme water have been extensively studied by the CEGI and ecological research carried out by them over period of many years has confirmed that adverse thermal effects from power stations are virtuall non-existent. (Upadhyaya-Vanderbilt)
W71-05136

THERMAL EFFECTS STUDIES FOR PALISADES NUCLEAR PLANT,
Consumers Power Co., Jackson, Mich.
John Z. Reynolds, and Kenneth A. Swarts.
Transactions of the American Nuclear Society Vo 13, No 1, p 233, July 1970.

Descriptors: *Thermal pollution, *Aquatic life Benthos, Plankton, Periphyton, Fish, Lake Michigan, Eutrophication, Nuclear powerplants. Water pollution effects.
Identifiers: Sampling methods, Palisades nuclear plant.

A brief summary of surveys of Lake Michigan aquatic ecology near the Palisades Nuclear Plant is presented. Data from two years of preoperational surveys will be available for correlation with conditions observed after the plant has been operating. Extent of surveys and sample methods are described. The biological studies are concentrated on the benthos, plankton, periphyton and fish. (Jones-Vanderbilt)
W71-05137

NEW JERSEY V CITY OF NEW YORK (REMEDY AGAINST CITY FOR POLLUTION OF STATE WATERS AND BEACHES).
For primary bibliographic entry see Field 06E.
W71-05142

E CHENA RIVER, THE STUDY OF A SUB-CTIC STREAM,
leral Water Quality Administration, College, ska. Alaska Water Lab.
primary bibliographic entry see Field 05B.
1-05143

E WEST FALMOUTH OIL SPILL-PER-TENCE OF THE POLLUTION EIGHT NTHS AFTER THE ACCIDENT,
ods Hole Oceanographic Institution, Mass.
mer M. Sass, J. G. Souza, H. L. Sanders, and J. Grassle.
ilable from NTIS as AD-713 947, $3.00 in er copy, $0.95 in microfiche. Technical Report, erence No 70-44, Sept 1970. 32 p, 18 fig, 3 tab, f. FWQA Grant 18050-EBN.
tifiers: *Water pollution, *Oils, *Shellfish, er pollution, *Marine biology, Bays, Toxicity, sachusetts, Pelecypoda, *Buzzards Bay, ater pollution damage, Sediments, Biodeteri-ion.

ill of 650,000-700,000 liters of no 2 fuel oil has taminated the coastal areas of Buzzards Bay, s.The present report summarizes the results of continuing chemical and biological study which e available at the end of May 1970, more than t months after the accident. The effects of en-nmental exposure on the composition of the oil liscussed; many analytical parameters are suffi-tly stable to permit continued correlation of oil remaining in sediments and organisms with uel oil involved in the spill.Oil from the spill is present in the sediments, inshore and offshore in the shellfish. A further spread of the pollu-to more distant offshore regions has occurred ng mid-winter; as a result, the pollution now rs a much larger area than immediately after accident. The first stages of biological sumably bacterial) degradation of the oil are evident especially in the least polluted regions; ever, it has depleted predominantly the straight branched chain alkanes.The more toxic aro-c hydrocarbons are resistant; as a result, the ity of the oil has not been diminished. Where an be detected in the sediments there has been of animals; in the most polluted areas the kill been almost total. Shellfish that survived the lent have taken up the fuel oil. The 1970 crop ellfish is as heavily polluted as was last year's Oysters transplanted to unpolluted water for ng as 6 months retained the oil without chance mposition or concentration.
-05149

TERICIDAL EFFECTS OF ALGAE ON EN-IC ORGANISMS,
s Univ., Austin. Center for Research in Water urces.
M. Davis, and Earnest F. Gloyna.
available from GPO Sup Doc as 3/4:18050 DOL 03/70, $1.25; microfiche NTIS as PB-197 862, $0.95. Water Pollution rol Research Series 18050 DOL 03/70, March 132 p, 114 tab, 9 fig, 60 ref, 3 append. A Program 18050 DOL.

riptors: *Algae, *Enteric bacteria, *Bacteri-, Growth stages, Pathogenic bacteria, ophyta, Chlorophyta, Scenedesmus, Algal s, Antibiotics (Pesticides), Data processing, orms, Microorganisms, Hydrogen ion concen-n, Waste water treatment, Water pollution ef-

ifiers: *Mixed cultures, Dieoff rates, After-h.

us enteric organisms were exposed to axenic res of green and blue-green algae to determine effect the algae might have. Tests were ex-d to 90 days to determine whether after-h was possible. Mixed cultures of both green lue-green algae were exposed to both single es and mixed cultures of enteric bacteria, at ng stages of the algae growth periods. Results ated that mixed cultures do have a unced bactericidal effect on enteric organ-isms, while for single algal species, the effect is less pronounced. Also, the bactericidal effects are more specific for pathogens, with virtually no after-growth of pathogens detected. (Lowry-Texas)
W71-05155

ACUTE TOXICITY OF LAS TO VARIOUS FISH SPECIES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Thomas O. Thatcher, and Joseph F. Santner.
Proceedings Industrial Waste Conference, 21st, March 1966, Purdue University, Vol L, No 2, March 1966, Part II, p 996-1002. 1 fig, 4 tab, 9 ref.

Descriptors: *Toxicity, *Fishkill, Mortality, Water pollution effects, *Linear alkylate sulfonates, *Alkylbenzene sulfonates, *Detergents, Aquatic life.

Tests with LAS products were conducted during 1965 on five species of fish to determine the toxicity of this compound to aquatic life. A comparison of LAS values versus ABS values obtained in a previous test, indicated that LAS is 2-4 times as toxic to fish as is ABS. The data from this test demonstrates that sufficient difference in sensitivity to LAS exists among species of fish to warrant attention to this factor when assessing the potential hazard of LAS to aquatic populations. (Ellis-Texas)
W71-05172

CAUSES OF OYSTER SPAT MORTALITY, CONDITIONS OF OYSTER SETTING BEDS, AND RECOMMENDATIONS FOR OYSTER BED MANAGEMENT,
Bureau of Commercial Fisheries, Milford, Conn. Biological Lab.
Clyde L. MacKenzie, Jr.
National Shellfisheries Association, 1969 Proceedings, Vol 60, p 59-67, June 1970. 4 tab, 16 ref.

Descriptors: *Oysters, *Silts, Water pollution sources, Mortality, Fouling, *Predation, Commercial shellfish.
Identifiers: *Mechanical breakage, *Suffocation, *Starvation, Bryozoan poisoning, *Crassostrea virginica, American oyster, *Spot mortality, Starfish, Oyster drills.

The causes of oyster spat mortality conditions of oyster setting beds and recommendations for oyster bed management are described. As part of a study of mortalities of American oysters, Crassostrea virginica. The causes were identified of mortality of oyster spat between setting and age of 6 months and their relative importance was compared. The causes were complex and varied widely from bed to bed. They were a result of predation by various species, overgrowth by others, mechanical breakage during transplanting, suffocation by silt, early post-setting mortality (cause unknown), and deaths apparently from starvation and, in one location, from poisoning by a bryozoan. Two factors prevented much larger sets of oysters on commercial beds: (1) a small supply of clean oyster shells available for commercial oyster companies to plant and (2) layers of fouling organisms and silt that accumulate on shells planted for any length of time. (Wahtola-Washington)
W71-05202

A COMPARISON OF THE TOXICITY OF SOME COMMON INDUSTRIAL WASTE COMPONENTS TESTED INDIVIDUALLY AND COMBINED,
Kansas Univ., Lawrence; and Academy of Natural Sciences, Philadelphia, Pa.
John Cairns, Jr., and Arthur Scheier.
The Progressive Fish-Culturist, Vol 30, No 1, p 3-8, January 1968. 3 tab, 8 ref. US Public Health Service Grants RRG-3965 and EF00266.

Descriptors: *Waste disposal, *Industrial wastes, *Bioassay, Toxicity, Temperature, Water pollution effects, *Sunfish, *Water quality control, Chemical wastes, Mortality, Lethal limit, Chromium, Copper.
Identifiers: *Synergistic effects, *Acetic acid, *Acetaldehyde, *Acetone, *Naphthenic acids, Potassium cyanide, Zinc.

A comparison of the toxicity of some common industrial waste components were tested. These components were tested individually and combined. It is known that components of an effluent may interact so that their collective toxic effect on aquatic organisms can substantially differ from their individual toxicities. They were divided into three categories; additive, antagonistic, or synergistic. No dramatic interaction between the various components of the mixtures tested was evident. Support was found for the practice of segregating certain waste components for intensive treatment before disposal or compositing other wastes. (McConnell-Washington)
W71-05205

CHRONIC EFFECTS OF METHOXYLCHLOR ON BLUEGILLS AND AQUATIC INVERTEBRATES,
Bureau of Sport Fisheries and Wildlife, Columbia, Mo. Fish-Pesticide Research Lab.
Harry K. Kennedy, Lafayette L.Eller, and David F. Walsh.
Technical Papers of the Bureau of Sport Fisheries and Wildlife, No 53, March 1970. 18 p, 6 fig, 35 ref, 8 tab.

Descriptors: *Insecticides, Aquatic animals, Pathology, Persistence, Juvenile fishes, *Halogenated pesticides, Chlorinated hydrocarbon pesticides, *Sunfishes, Bioassay, *Water pollution effects, Mortality, Fish physiology, Fish reproduction, Pesticide residues, Diptera, DDT.
Identifiers: *Methoxychlor, Baetidae, Heptageniidae, Coenagrionidae, Physidae.

The chronic effects of methoxychlor on bluegills and various aquatic invertebrates is described. Bluegills (average weight 7 grams, average fork length 73 mm) were exposed to methoxychlor at concentrations of 0, 0.01, and 0.04 ppm in ponds for 13 weeks in late summer. Fish losses were small and not attributable to methoxychlor exposure. There were no significant differences in fish growth in the three pairs of ponds. Pathologic changes occurred in tissues and organs, primarily in livers and circulatory systems. Precipitated materials were observed in major blood vessels of gills and hearts 24 hours after treatment. This material coalesced, became multivacuolated, was conspicuous in most large blood vessels of every organ during the first week after treatment, persisted through day 28, and disappeared by day 56. Methoxychlor uptaken by the fish in 004-ppm-treated ponds was rapid, 21ppm by day 3; the insecticide was stored in whole body tissues through day 28 and metabolized or excreted by day 56. Significantly higher numbers of aquatic insects were sampled in treated ponds than in untreated, and insect numbers at high-treatment ponds were significantly higher than at low-treatment ponds. Chironomids were dominant and significantly increased after the 0.04-ppm treatment. Chironomids comprised 74 percent of samples from high-treatment ponds, but only 43 and 42 percent respectively from untreated and low-treatment ponds. Mayflies of the family Baetidae were less common. (Wahtola-Washington)
W71-05206

FISH AND CRAYFISH MORTALITIES DUE TO AN INTERNAL SEICHE IN GEORGIAN BAY, LAKE HURON,
Department of Lands and Forests, Maple (Ontario). Research Branch.
Alan R.Emery.
Journal of the Fisheries Research Board of Canada, Vol 27, p 1165-1168 1970. 9 ref, 1 tab, 1 fig.

Descriptors: *Thermal pollution, *Fish, *Great Lakes, Behavior, Sculpins, Crayfish, Trout, Perches, *Seiches, Fishkill, Mortality, Turbidity, Light penetration, Temperature.

Identifiers: *Lake Huron, Georgian Bay, *Orconectes.

Fish mortality due to an internal seiche is described. An internal seiche in Georgian Bay, Lake Huron, altered water temperatures and transparency in Little Dunks Bay (a small shallow bay). A sudden decrease in temperature was the probable cause of mortalities in sculpins (Cottus bairdi) and crayfish (Orconectes propinquus) as well as of marked changes in behavior of other fish species. Trout-perch (Percopsis omiscomaycus) appeared unaffected. (Wahtola-Washington)
W71-05208

FISHERY IMPLICATIONS ASSOCIATED WITH PROLONGED TEMPERATURE AND OXYGEN STRATIFICATIONS,
Arizona Cooperative Fishery Unit, Tucson.
Charles D. Ziebell.
Journal of the Arizona Academy of Science, Vol 5, No 4, p 252-262, October 1969. 5 fig, 13 ref.

Descriptors: *Temperature, *Oxygen, *Stratification, Solar radiation, Thermocline, Arizona, Fish behavior, Fish management, Hypolimnion, *Thermal stratification, Fisheries, Fish populations.
Identifiers: Overcrowding, Pena Blanca Lake.

Fishery implications associated with prolonged temperature and oxygen stratification for Pena Blanca Lake, Arizona, are described. The lake is stratified from March through November, which results in severe oxygen depletion in the hypolimnion. Possible overcrowding of mixed fish populations might cause inter-intraspecific competition for food and space. The unique limnology of Southern Arizona lakes cause unusual and challenging problems for fisheries management. (Katz-Washington)
W71-05209

AN ANAESTHETIC FOR COROPHIUM VOLUTATOR (PALLAS) AND MARINOGAMMARUS OBTUSATUS (DAHL), CRUSTACEA, AMPHIPODA,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
J. C. Gamble.
Experientia 25, p 539-540, 1969. 2 tab, 2 fig, 8 ref.

Descriptors: *Amphipoda, Temperature, Fish, *Crustaceans, Sea water, Aquatic animals, Fish physiology.
Identifiers: MS-222, *Anaesthetics, Corophium volutator, Marinogammarus obtusatus.

The experiments showed that MS-222 Sandoz is an effective anaesthetic for marine amphipods, Corophium volutator and Marinogammarus obtusatus. The optimal effective concentration is relatively high (1:2000) when compared with the doses (1:25,000 to 1:12,000) recommended for fishes. The fish, like amphipods, are anaesthetized easily, but take longer to recover after prolonged immersion in the anaesthetic. (Wahtola-Washington)
W71-05210

THE EFFECT OF CHINA CLAY ON THE BOTTOM FAUNA OF ST. AUSTELL AND MEVAGISSEY BAYS,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
B. R. Howell, and R. G. J. Shelton.
Journal of the Marine Biological Association, Vol 50, p 593-607, 1970. 1 tab, 10 fig, 13 ref.

Descriptors: *Clay, *Deposition (Sediments), Fish, *Water pollution effects, *Benthic fauna, Industrial wastes, *Annelids, *Mollusks, Aquatic animals, Gastropods.
Identifiers: *Echinoidea, *Holothurioidea, China clay, *Ophiuroidea

The deposition of china-clay waste has had a marked effect on the bottom fauna of St. Austell and Mevagissey Bays. Apart from an immediately inshore zone, where the rate of clay deposition is apparently severely limiting, the clay-affected zones support a rich community of deposit-feeding animals. Suspension-feeding forms which are common outside the clay deposits and in an adjoining bay, are largely absent from St. Austell and Mevagissey Bays. The behavior of pelagic fish in water polluted by clay wastes was investigated, but it was noted that fish would avoid the high turbidity. (Wahtola-Washington)
W71-05211

EVALUATING THE EFFECT OF INDUSTRIAL WASTES ON LAGOON BIOTA,
Missouri Univ., Columbia. Dept. of Civil Engineering.
Hardam S. Azad, and Darrell L. King.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Purdue University, Vol XLIX, No 3, p 410-422, July 1965. 7 fig, 1 tab, 21 ref.

Descriptors: *Biota, *Lagoons, *Industrial wastes, *Copper, *Chromium, Aquatic life, Respiration, Metabolism, Oxygen requirements, Photosynthesis, Hydrogen ion concentration, *Toxicity, Water pollution effects, Waste water treatment.
Identifiers: Potassium dichromate, Copper sulfate, Warburg.

A method was proposed which can be used to evaluate the shock load toxicity of a particular waste to the biota peculiar to a given lagoon before the waste is introduced to the lagoon. In order to do this the metabolic degradation of domestic wastes was evaluated by at least four different methods and for a wide variety of biotic communities. The impact of copper and chromium on lagoon metabolism was determined by comparing the oxygen demand of the samples subjected to the metals to that of a control containing just lagoon effluent. Copper, fed as copper sulfate, in concentrations greater than 0.20 mg/l was shown to seriously affect the performance of a waste stabilization lagoon while shock loads of hexavalent chromium, fed as potassium dichromate, were shown not to have any appreciable affect on lagoon performance at concentrations up to 40 mg/l. A significant depression of the pH and evolution of a gas appearing to be CO sq accompanies slug doses of Cu greater than 2.0 mg/l and Cr greater than 50 mg/l. (Ellis-Texas)
W71-05280

TOXICITY OF COPPER TO ACTIVATED SLUDGE,
Mead Corp., Chillicothe, Ohio.
For primary bibliographic entry see Field 05D.
W71-05284

DISPERSANT TOXICITY TEST PROCEDURES,
Ministry of Agriculture, Fisheries and Food, Burnham-on Crouch (England). Fisheries Lab.
R. G. J. Shelton.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No 4040, p 187-191. 7 ref.

Descriptors: *Oil wastes, Water pollution control, Cleaning, Chemicals, *Toxicity, *Aquatic life, *Bioassay, Water pollution effects.
Identifiers: Effectiveness evaluations, *Dispersants, Oil pollution, Coastal pollution.

Toxicity of chemicals to disperse oil is considered in relation to effects on fisheries and marine life. Toxic dispersants should not be used in large quantities in shallow coastal water, over shellfish beds, or fish nursery grounds, or in estuaries. Mechanical methods should be used in these areas and chemical methods used only on high-amenity beaches. Many commercially available dispersants and some experimental formulations have been tested. Oil and dispersants may affect fisheries marketa by adding displeasing flavours to fish and shel (See also W70-10035) (Ensign-PAI)
W71-05331

STANDARD METHODS FOR DETERMI TION OF RELATIVE TOXICITY OF DISPERSANTS AND MIXTURES OF DISI SANTS AND VARIOUS OILS TO AQUATIC GANISMS,
Federal Water Pollution Control Administra Washington, D.C. National Marine Water Qu Lab.
C. M. Tarzwell.
Prevention and Control of Oil Spills, Joint ference, Proceedings, New York, New December 15-17, 1969, Co-sponsored by A ican Petroleum Institute and U.S. Federal W Pollution Control Administration, Washing D.C., American Petroleum Institute Publicatio 4040, p 179-186. 7 fig, 2 tab, 2 ref.

Descriptors: *Oil wastes, Water pollution con Cleaning, Chemicals, *Toxicity, *Aquatic *Bioassay, ater pollution effects, Pollutant ide cation, Dispersion, Oily water.
Identifiers: Oil pollution, *Dispersants.

The relative toxicity of all chemical dispers both alone and in combination with oil, is d mined prior to use for oil dispersion and the c ing of beaches by the F. W. P. C. A. Data on relative toxicity of these chemicals provide grounds for the selection of these materials toxic to aquatic life and for recommending prohibiting their use. The F. W. P. C. A. feels t is the responsibility of the manufacturer of t products to provide for their product alone an oil mixture tolerance limit values based on stan short-term bioassays with designated test or isms. The F. W. P. C. A. recommends the stan bioassay procedure. This procedure is solely fo purpose of providing data to indicate relative icity of dispersants and dispersant mixtures. T tests do not indicate long-term toxicity of t chemicals or constitute an endorsement of product by the F. W. P. C. A. (See also W 10035) (Ensign-PAI)
W71-05332

5D. Waste Treatment Processes

LIQUID WASTE IN THE PULP AND PAPER DUSTRY,
Stanley Associates Engineering, Ltd., Edmon (Alberta).
D. R. Stanley.
Mand and His Environment, Vol 1, Proceeding the First Banff Joint Conference on Pollution, University of Calgary and the Engineering Insti of Canada, May 16-17, 1968, Banff, Albe Canada: New York, NY, Pergamon Press, In 43-51, 1970. 9 p, 3 fig, 1 tab.

Descriptors: *Water pollution sources, *Pulp paper industry, *Pulp wastes, *Waste treatm Methodology, Activated sludge, Trickling filt Lagoons, Evaluation, Water quality, Chem analysis, Biochemical oxygen demand, Model dies, Nitrogen, Phosphorous.

Water pollution problems due to liquid waste fr the pulp and paper industry and methods of tr ment to alleviate these problems are described specific problem of stream pollution due to wa from a bleached Kraft pulp mill in Alberta presented and the approach used in solving problem outlined. Several methods of treatm were considered including activated sludge, tri ling filters, aerated lagoons and anaerobic lagoo The activated sludge process provided the most liable method of alleviating the problem, but wo have been very expensive. The aerated lagoon t of treatment was considered to have the best pot tial as a technically feasible and economic solut to the problem. (See also W71-04901) (Wooda USGS)

V71-04902

ETROCHEMICAL WASTE DISPOSAL,
)epartment of Health, Edmonton (Alberta).
'or primary bibliographic entry see Field 05E.
V71-04903

INDING PROFITS IN OIL-WELL WASTE VATERS,
ureau of Mines, Bartlesville, Okla. Bartlesville etroleum Research Center.
. G. Collins.
'hemical Engineering, Vol 77, No 20, p 165-168, eptember 21, 1970. 4 p, 3 fig, 3 tab, 13 ref.

escriptors: *Byproducts, *Brines, *Oil fields, Brine disposal, Water reuse, Reclaimed water, esalination, Waste water disposal.
lentifiers: Oil field brines.

ull exploitation of petroleum-associated brines for eir chemicals will benefit the oil producer, the ational economy, and pollution abatement. Sound nservation should favor the recovery of valuable ements from these brines, and with proper anning, the recovery processes should aid in ultiate disposal. A brine must contain a certain nount of recoverable chemicals before it can be nsidered economically valuable, and the further must be pumped, the more chemicals it must conin. Several petroleum-associated brines contain ough sodium for the economical production of dium chloride. This, coupled with the resultant llution reduction and the presence of economic ncentrations of other elements, should make emical recovery from such brines still more atactive. Elements found in economic concentrans include magnesium, calcium, potassium , hium, boron, bromine, and iodine, many of which e now recovered from seawater, salt lakes and bsurface saline waters. (Knapp-USGS)
'71-04907

EROBIC STABILIZATION OF BEEF EEDLOT WASTE,
exas Tech Univ., Lubbock.
. Grub, J. D. Martin, and L. L. Keeton.
aper presented at the 1970 winter meeting Amerian Society of Agricultural Engineers, Chicago, ecember 8-11, 1970, Paper No 70-909. 6 p.

escriptors: *Anaerobic digestion, *Biological eatment, Farm wastes, Moisture content, Aerobic nditions, Oxygen requirements, Stabilization, itrogen, Waste water treatment.
entifiers: *Composting, *Carbon to nitrogen tio (C/N), Housefly.

olid waste that had accumulated on Southwestern ef cattle feedlots was aerobically stabilized under ntrolled conditions in enclosed digesters and in en air piles. Conditions for stabilization were termined and changes of physical, chemical and ological characteristics were established. The ornic stabilization of beef feedlot waste by comsting is a feasible process. Organic beef feedlot aste is compostable in specially designed digesters in exposed open air piles, to a biologically stable ganic product, free from noxious odors and inset festation. Stabilized waste can be stored in a wet dry state without danger of heating, attracting sects, or causing noxious odors. The time of staization depends on the type of original feed aterial, the condition of the waste at the start of e composting period, and the management of the mposting process. Composting requires skilled anagement to obtain satisfactory results. Christenbury-Iowa State)
71-04911

AS PRODUCTION FROM BEEF CATTLE ASTES,
exas Tech Univ., Lubbock.
F. Meenaghan, D. M. Wells, R. C. Albin, and W. ub.

Paper presented at the 1970 winter meeting American Society of Agricultural Engineers, Chicago, December 8-11, 1970, Paper No 70-907. 15 p, 9 fig.

Descriptors: *Anaerobic digestion, *Gases, Farm wastes, Chemical oxygen demand, Cattle, Carbon, Nitrogen, Hydrogen, Alkalinity, Methane, Biochemical oxygen demand, Waste treatment, Air pollution, Pollution abatement.
Identifiers: *Composting, *Gas production, Carbon to nitrogen ratio (C/N), Beef cattle, Carbonaceous material, Volatile acids.

A two-stage completely mixed isothermal digestion system having a capacity of 30 gallons/stage was fed wastes from a beef cattle controlled environment chamber. Gas production was monitored and analyzed by a wet test meter and a gas chromatograph, respectively. Physical and bio-chemical tests were also performed. This study indicates that a completely mixed, two stage anaerobic digestion system is technically feasible and can be used for obtaining nominal treatment of beef cattle wastes. Even with optimal conditions per stage such a system will not be sufficient for complete treatment. (Christenbury-Iowa State)
W71-04912

EFFECTS OF MANURE DEPTH ON RUNOFF FROM SOUTHWESTERN CATTLE FEEDLOTS,
Texas Tech Univ., Lubbock.
For primary bibliographic entry see Field 05B.
W71-04913

IN VITRO DIGESTIBILITY OF CHEMICALLY-TREATED FECES,
Department of Agriculture, Beltsville, Md. Animal Science Research Div.
L. W. Smith, H. K. Goering, and C. H. Gordon.
Journal of Animal Science, Vol 31, No 6, p 1205-1209, December 1970. 4 tab, 16 ref.

Descriptors: *Digestion, *Chemical degradation, Farm wastes, Ruminants, Fermentation, Cellulose, Costs, Alkalis, Waste treatment.
Identifiers: *Chemically-treated feces, Cell wall, Microbial responses, Oxidants.

Chemical treatment is a means for enhancing the digestibility of the indigestible plant cell wall residues in ruminant feces. Enhanced digestibility was ascertained with detergent solubility methods and in vitro rumen fermentation were obtained through dried chemical degradation of meicellulose, cellulose, and lignin and also through increasing the accessibility of the remaining cell wall for ruminal microbial fermentation. Chemical treatment of indigestible alfalfa or sudax fecal cell walls resulted in greater than 90% digestion (chemical degradation and microbial digestion). This experiment was designed to point out some of the conditions required for maximum chemical hydrolysis and maximum cell wall utilization. Whether or not these conditions can be approximated in feeding trials remains to be demonstrated. (Christenbury-Iowa State)
W71-04915

CATTLE WASTES - POLLUTION AND POTENTIAL TREATMENT,
Kansas Univ., Lawrence. Dept. of Civil Engineering; and Kansas Univ., Lawrence. Environmental Health Engineering Lab.
Raymond C. Loehr, and Robert W. Agnew.
Journal of the Sanitary Engineering Division, ASCE, Vol 93, No SA4, p 55-72, August 1967. 2 fig, 9 tab, 29 ref.

Descriptors: *Farm wastes, *Cattle, *Water pollution sources, Rivers, Fishkill, Moisture content, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Anaerobic digestion, Oxygen demand, Lagoons, Hydrogen ion concentration, Effluent, Aeration, Sludge, Runoff, Waste water treatment.
Identifiers: *Feedlots, Cattle production, Pollution potential, Loading rages, Profit potential, Waste characteristics, Total solids, Population equivalent, Digesters, Anaerobic lagoons.

The problem of cattle feedlot waste treatment and the results illustrated in this paper can be summarized as follows: The diversified family farm is giving way to specialized large-scale factory-type operations such as beef cattle feedlots. Farm enterprises which formerly were dispersed over large remote land areas are now concentrated in small areas, frequently near communities, and intensify problems of waste disposal. Runoff from feedlots is a significant problem and treatment systems must be able to handle slug loads and flows without causing stream pollution. The profit potential and the amount of concern of the feedlot operator for adequate waste treatment will dictate the type of system that will be practical and economical. The quantity and the undesirable qualities of the wastes from a beef feedlot are such that a combination treatment system may be the most successful. A combined anaerobic-aerobic lagoon system has significant potential. The effluent from an anaerobic lagoon is potent and must receive further treatment before discharge to a receiving stream. Even after adequate removal of organics, the effluent may pose a problem because of its color and its fertilization capacity. (White-Iowa State)
W71-04916

THE COLLECTION OF MANURE FROM HOUSED LIVESTOCK,
West of Scotland Agricultural Coll., Glasgow (Scotland). Dept. of Farm Buildings.
R. J. Forsyth.
Journal and Proceedings of the Institution of Agricultural Engineers, Vol 21, p 129-133, 1965.

Descriptors: *Farm wastes, *Cattle, Water pollution control, Sludge, Storage capacity, Storage tanks, Waste dilution, Construction materials, Costs, Slurries, Sluice gates, Electric power costs, Rotors, Waste water treatment.
Identifiers: *Dairy cattle, *Oxidation ditch, Slatted floors.

The paper describes collection and handling methods for dairy manure in Scotland. Parlor systems are scarce because of their large bedding requirement. Slatted floors in conjunction with free housing systems has proven highly satisfactory. Different slat types are discussed and evaluated. Under slat tanks or channels are described as well as criteria for dilution, storage capacity, and sluice gates. The possibility of using the Pasveer oxidation ditch is introduced as a result of stringent pollution regulation. Design and costs for the oxidation ditch are presented. A discussion follows the paper. (White-Iowa State)
W71-04917

AEROBIC PURIFICATION OF FARM WASTE,
Rijkszuivel Agrarische Afvalwater Dienst, Arnhem (Netherlands).
H. M. J. Scheltinga.
Journal Proceedings of the Institution of Sewage Purification, p 585-588, 1966. 1 fig, 4 tab, 11 ref.

Descriptors: *Farm wastes, *Hogs, *Biological treatment, Anaerobic digestion, Activated sludge, Rotors, Nitrogen, Biochemical oxygen demand, Chemical oxygen demand, Foaming, Nitrification, Costs, Effluent, Laboratory tests, Ammonia, Waste water treatment.
Identifiers: *Oxidation ditch, Loading rates, Retention time.

Model tests, laboratory investigations, and finally a full scale field experiment with oxidation ditches were carried out in Holland, where an effective and economical waste treatment system is being sought. A 50 per cent BOD reduction was obtained using anaerobic decomposition in the laboratory. Initial and final characteristics of the pig waste are given before and after treatment in the oxidation ditch.

Foaming was excessive from the start. Nitrification played an important part in eliminating the ammonia. Total and expected operational costs are given. (White-Iowa State)
W71-04920

THE BACTERIAL POPULATION OF AN INDOOR POULTRY LAGOON,
Louisiana State Univ., Baton Rouge. Agricultural Experiment Station; and Louisiana State Univ., Baton Rouge. Dept. of Microbiology; and Louisiana State Univ., Baton Rouge. Dept. of Agricultural Engineering; and Louisiana State Univ., Baton Rouge. Dept. of Poultry Science.
Leon J. Cabes, Jr., Arthur R. Colmer, Harold T. Barr, and Benjamin A. Tower.
Poultry Science, Vol 48, No 1, p 54-63, 1969. 2 fig, 3 tab, 17 ref.

Descriptors: *Farm wastes, *Poultry, *Oxidation lagoon, Microorganisms, E. coli, Aeration, Sampling, Coliforms, Bacteria, Pathogenic bacteria, Temperature, Hydrogen ion concentration, Biochemical oxygen demand, Aerobic bacteria, Waste water treatment.
Identifiers: *Laying house, *Bacterial counts, Enterococci, Suspended solids, Manometric studies.

The study was concerned, first, with the enumeration, isolation, and classification of the predominant bacterial flora of an indoor poultry waste stabilization lagoon, and secondly, with an evaluation of this flora to determine the organisms most active in the degradation process. The lagoon consisted of a pit 3 feet 6 inches deep x 13 feet wide x 88 feet long inside a laying house which measured 14 feet x 100 feet. The standard plate counts of aerobic organisms present in the waste water of the lagoon are presented in tabular form. Total solids, pH and BOD reduction data are also presented. The lagoon was aerated with 200 feet of perforated pipe which feed 4 cfm of air at 15 psi. It is felt that additional modifications might be instituted. (White-Iowa State)
W71-04921

NUTRITIVE VALUE OF OXIDATION-DITCH RESIDUE,
Illinois Univ., Urbana.
B. G. Harmon, A. H. Jensen, and D. H. Baker.
Journal of Animal Science, Vol 29, No 1, p 136, July 1969.

Descriptors: *Nutrients, Farm waste, Feeds, Value, Aerobic treatment, Diets, Amino acids, Energy, Waste water treatment.
Identifiers: *Excreta, *Swine, Feed value, Oxidation-ditch, Rats.

Swine excreta suspended in water and adjutated to promote aerobic digestion was studied as a source of nutrients. In four growth trials 132 weanling rats were used to study the nutritive value of amino acids and energy contained in the oxidation-ditch residue (ODR). The digestible energy decreased linearly as ODR was added to the diet. (Christenbury-Iowa State)
W71-04922

LOSSES OF ENERGY AND NITROGEN ON DRYING POULTRY EXCRETA,
Queen's Univ., Belfast (Northern Ireland). Dept. of Agricultural Chemistry.
D. W. F. Shannon, and W. O. Brown.
Poultry Science, Vol 48, p 41-43, 1969. 1 tab, 3 ref.

Descriptors: *Farm wastes, *Poultry, Energy, Nitrogen, Drying, Freeze drying, Vacuum drying, Forced drying, Temperature, Waste treatment.
Identifiers: Kjeldahl nitrogen, Metabolizable energy, Dry matter.

Losses of energy and nitrogen were determined from samples of fresh excreta differing in dry matter and nitrogen content. The samples were dried under the following conditions - freeze drying, vacuum drying at 40C and drying in forced-air ovens at 60C, 100C, and 120C. Nitrogen of the undried and dried excreta was determined by the conventional Kjeldahl method. The mean results of ten energy determinations (%) on fresh excreta samples A and B were 804, 753, 2.51 respectively. The energy losses are in agreement with other authors. From the results of the experiment, the drying temperature should be chosen depending on whether the energy or nitrogen content is more important. In the determination of metabolizable energy, then the method giving lower energy errors would be used. (White-Iowa State)
W71-04925

PHYSICAL AND BIOLOGICAL EVALUATION OF FIVE LITTER MATERIALS,
Purdue Univ., Lafayette, Ind. Dept. of Animal Sciences.
Paul L. Ruszler, and James R. Carson.
Poultry Science, Vol 47, p 1712, 1969.

Descriptors: *Farm waste, *Poultry, *Absorption, Moisture, Particle size, Laboratory tests, Waste water treatment, Waste treatment, Water pollution effects.
Identifiers: *Litter materials, Field conditions, Peanut shells, Pine bark, Ground cobs, Wood shavings, Cane pomace.

The usefulness of peanut shells, pine bark, ground cobs, wood shavings and cane pomace as litter materials in rooster production was evaluated under laboratory and field conditions on the basis of their physical properties and effects on the birds during a 14-week growing period. When the amount and rate of moisture exchange was compared, it was found that all five materials differed significantly. When ranked by grams of moisture absorbed per gram of dry weight, cane was highest, followed by shavings, cobs, shell, and bark. The materials with the smaller particle sizes absorbed less total moisture in both growing house and laboratory tests. The same materials rated low in breast blister incidence, but without statistical significance. (White-Iowa State)
W71-04926

THE SEARCH FOR NEW POULTRY LITTER MATERIAL - AN EXAMPLE OF COOPERATION BETWEEN EXTENSION, RESEARCH AND INDUSTRY,
Georgia Univ., Athens. Dept. of Poultry Science.
Milton Y. Dendy, M. J. Reed, and M. G. McCartney.
Poultry Science, Vol 45, p 1666, 1968.

Descriptors: *Farm wastes, *Poultry, Physical properties, Performance, Agricultural engineering, Waste treatment, Pollutants.
Identifiers: *Litter materials, Pine bark, Pine bark and chips, Pine stump chips, Rice hulls, Poultry industry, Extension Poultrymen.

In the fall of 1966 a litter shortage was brought to the attention of the Extension Poultrymen during an industry meeting. The Extension Poultrymen took the problem to the research people in the Department of Poultry Science and the Department of Agricultural Engineering at the University of Georgia, and a project was started to test (1) the physical properties and performance characteristics of materials usable as litter in poultry houses, and (2) bird performance on several materials available in Georgia were tested, including pine shavings and pine sawdust, the two materials most commonly used. Results obtained indicate that some of the materials such as pine bark, pine bark and chips, pine stump chips and rice hulls are about as suitable for poultry litter as pine shavings or pine sawdust. (White-Iowa State)
W71-04928

THE DIGESTION OF POULTRY FECES UNDER CAGES,
Auburn Univ., Ala. Dept. of Poultry Science.
J. R. Howes.
Poultry Science, Vol 47, p 1682, 1968.

Descriptors: *Farm wastes, *Poultry, *Aerob conditions, Odor, Aerobic bacteria, Fertiliz Nitrogen, Stabilization, *Waste treatment.
Identifiers: *Absorbent substrate, *Cage operatio *Inoculation, Control plots.

A series of small experiments were carried o under cages with and without concrete floors, usi various absorbent substrates for poultry fece After an initial buildup period, the feces and su strate was inoculated with aerobic bacteria a aerobic conditions maintained by disturbing t surface cake at intervals. These experiments led a field trial without any absorbent substrate at large cage operation in south Florida, which h now been in operation for 18 months. Odors a flies have been largely eliminated except in contr plots and spraying for fly control greatly reduce The bulk of the fecal pile was less than half th volume of the control plots due to stabilization nitrogen and water losses. Feathers were digested they were incorporated into the fecal pile and th resulting material was a homogenous, odorless fe tilizer which has been used in urban gardens and o golf greens. (White-Iowa State)
W71-04929

CATALYTIC OXIDATION OF ORGANIC COM POUNDS IN WASTE WATER,
Southern Illinois Univ., Carbondale. Dept. o Chemistry; and Illinois Univ., Urbana. Wate resources center.
Gerard V. Smith, F. Patil, Yuri Pavlov, and Juh V. Chen.
Available from NTIS as PB-197 733, $3.00 i paper copy, $0.95 in microfiche. Illinois Wate Resources Center, Urbana, Research Report N 36, January 1971. 18 p, 7 tab, 2 fig, 9 ref. OWR Project B-022-Ill (1).

Descriptors: *Tertiary treatment, *Waste wate treatment, Municipal wastes, *Organic wastes *Separation techniques, *Oxidation.
Identifiers: *Catalysis, Ultransonic destruction *Catalytic oxidation, Catalytic destruction, *Mu nicipal waste water.

Through studies of the effect of ultrasound on catalysts it has been found that certain water pollutants can be oxidized or modified. This synergetic effect between ultrasound and certain heterogeneous catalysts, sonocatalysis, is demonstrated qualitatively for a number of organic compounds (anilines, stilbestrol, orthochloronitrobenzene and phenol) and quantitatively for the oxidation of iodide ion. The technique shows promise as a tertiary treatment of municipal waste water. (Smith-Illinois)
W71-04936

SPECIALIZED HALOGEN GENERATOR PATENT APPLICATION,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
R. A. Bruce.
Available from NTIS as N70-35681, $3.00 in paper copy, $0.95 in microfiche. NASA Case XLA 8913, Serial No 865109, Oct 9, 1969. 11 p.
Identifiers: *Chlorination, *Gas generators, *Potable water, *Spacecraft environments, Closed ecological systems, Patent applications.

An apparatus is described for generating controlled quantities of a halogen gas as needed in a water purifying system. The apparatus is designed to eliminate bacteria from contaminated water and render it safe for human consumption. The chlorine generator is for use in a closed integrated life support system on board manned spacecraft for sterilizing potable water and maintaining stowed water in a sterile condition.
W71-04941

TENTION TIME AND CIRCULATION UDY IN A SEWAGE STABILIZATION GOON,
ological Survey, Raleigh, N.C.
lliam G. Stamper.
r sale by Superintendent of Documents, US vernment Printing Office, Washington, DC 402 - Price $3.75. Geological Survey Research 70, Chapter D, Professional Paper 700-D, p 01-D304, 1970. 4 p, 3 fig, 1 ref.

scriptors: *Tracers, *Dye releases, *Sewage oons, *Sewage treatment, *Water circulation, rth Carolina, Oxidation lagoons, Fluorescence. ntifiers: *Benson (NC).

o sewage stabilization lagoons used by the town Benson, N.C., were suspected of having an rage retention time much less than the designed days. A short circuit in the flow pattern was pected to be the cause. During the summer of 9, fluorescent dye was injected into the two oons in studies designed to determine the rage retention time and the flow pattern of each age lagoon. The retention times were found to considerably less than 30 days, and a definite rt circuit in the flow pattern was shown to exist. app-USGS)
1-04978

ATING WASTE-CONTINUOUS OR BATCH EATMENT,
neral Motors Corp., Detroit, Mich. Plant En-ering Section.
Delos.
ceedings, Industrial Waste Conference, 22nd, 2, 3, 4, 1967, Purdue University, Vol LII, No 138-144, July 1968. 5 fig, 1 tab.

criptors: *Chromium, *Waste water treatment, ts, Acids, Hydrogen ion concentration, tralization, Industrial wastes.
tifiers: *Cyanide, *Batch treatment, *Plating es.

ral Motors Corporation conducted tests at r Syracuse Plant to determine whether continu- or batch treatment was the better mode of ting plating waste. The batch system is being l since it offers a greater amount of safety ough the initial capital cost is higher than con-ous flow. Continuous flow requires constant at-ance along with the need to provide an excess hemical treatment for cyanide and chromium. n the batch system, no untreated wastes leave plant because of a malfunction of automatic pment. (Ellis-Texas)
-04998

D MINE DRAINAGE RESEARCH AT THE O STATE UNIVERSITY,
o State Univ., Columbus. Dept. of Chemical neering.
primary bibliographic entry see Field 05G.
-04999

LD STUDIES ON AN ANAEROBIC LAGOON ATING SLAUGHTERHOUSE WASTE,
ic Health Service, Shiprock, N. Mex.
n E. Enders, Mark J. Hammer, and Clinton L. er.
eedings, Industrial Waste Conference, 22nd, 2, 3, 4, 1967, Purdue University, Vol LII, No 126-137, July 1968. 5 fig, 6 tab.

riptors: *Anaerobic conditions, Anaerobic eria, Lagoons, Temperature, Hydrogen ion entration, Effluents, Dissolved oxygen, mical oxygen demand, Biochemical oxygen de-d, Industrial wastes, *Waste water treatment, dation lagoons.
tifiers: *Slaughterhouse wastes.

ies were performed on anaerobic lagoon waste ment units located in the rural countryside of heast Nebraska to determine their effective-ness in treating slaughterhouse wastes. If designed in accordance with accepted methods, anaerobic lagoons can be used as a first stage treatment and also have the capacity to handle shock loads and intermittent loadings without significant loss of treatment efficiency. The BOD removal during these studies was greater than 980% and solids buildup appeared to be extremely slow. The primary bacterial activity was the conversion of volatile solids to gaseous end products. (Ellis-Texas)
W71-05000

ELIMINATION OF NITRATE FROM AN INDUSTRIAL WASTE,
Badische Anilin- und Soda-Fabrik, A.G., Ludwigshafen am Rhein (West Germany).
Walter Haltrich.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 203-210, July 1968. 5 fig, 8 ref.

Descriptors: *Denitrification, *Acitvated sludge, Nitrogen, Nitrite, Nitrates, Biochemical oxygen demand, *Aeration, Sedimentation, Effluent, Organic compounds, Aromatic compounds, Alcohols, Indurstrial wastes, *Waste water treatment, Aerobic conditions, Anaerobic conditions, *Organic wastes, Biological treatment.
Identifiers: Aliphatic compounds, Aldehydes.

Studies were conducted to what effect denitrification can be accomplished in activated sludge. Continuous-flow experiments as well as batch studies were conducted under aerobic and anaerobic conditions. As a result of these experiments it was found that efficient denitrification of an industrial waste can be achieved with the activated sludge process if the nitrate is split in an unaerated stage preceding aeration. If the waste water contains organic impurities (hydrogen donors), denitrification proceeds so rapidly that the dentention time in a plant with denitrification is no greater than a conventional activated sludge plant. (Ellis-Texas)
W71-05001

NEW DEVELOPMENTS IN THE TREATMENT OF METAL FINISHING WASTES BY ION EXCHANGE OF RINSE WATERS,
Bavarian Bureau of Water Supply and Pollution Control, Munich (West German).
Friedick K. Von Ammon.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 788-799, July 1968. 6 fig, 4 tab.

Descriptors: *Recirculated water, *Ion exchange, Cation exchange, Anion exchange, Water reuse, Industrial water, Hydrogen ion concentration, Detergents, Costs, Metals, *Waste water treatment.
Identifiers: Metal refinishing, Germany, Rinse water, Cyanide, *Metal finishing wastes.

The advantages and problems of ion exchange and recirculation are discussed from the experiences of three new plants in Germany. The type and situation of the plants, collection of rinse waters, the design and operation of the ion exchange process, the properties of the circulated water, the waste water treatment, the properties of final effluent, and economic considerations are discussed. Recirculation was found to be more economical unless costs for water supply are extremely low or no waste treatment is required. Recirculation results in the reduction in waste quantity which gives obvious advantages for reduced waste treatment and a lower pollution load on receiving waters. (Ellis-Texas)
W71-05002

ACTIVATED SLUDGE TREATMENT OF SOME ORGANIC WASTES,
Water Pollution Research Lab., Stevenage (England).
A. B. Wheatland.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 983-1008, July 1968. 14 fig, 8 tab, 2 ref.

Descriptors: *Activated sludge, *Organic wastes, Domestic wastes, Farm wastes, Industrial wastes, Sewage, Biochemical oxygen demand, Aeration, Chemical oxygen demand, *Waste water treatment.
Identifiers: *Contact stabilization, Sludge volume index, Suspended solids.

Four investigations of the suitability of activated sludge or its modifications, in treating waste waters from : (1) the production and dyeing of a synthetic fiber; (2) a mixed effluent from the dyeing of Terylene, Nylon, and polyacrylic fibers; (3) the production of a synthetic rubber; and (4) a partial treatment of dairy effluent. The process can be successfully used for the treatment of waste waters from a variety of industries if suitable conditions are provided for the microorganisms to become acclimatized to the wastes. It may be necessary to dilute the waste water if it contains significant concentrations of potentially toxic or inhibitory organic substances and domestic sewage should be considered as a diluent if the waste water under consideration lacks certain inorganic nutrients or trace elements necessary to enhance treatment. (Ellis-Texas)
W71-05003

USE OF POLYELECTROLYTE COAGULANTS TO ENHANCE SETTLING CHARACTERISTICS OF ACTIVATED SLUDGE,
Weston (Roy F.), Inc., Newtown Square, Pa.
J. F. H. Walker, and J. H. Dougherty.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 715-723, July 1968. 6 fig, 1 tab.

Descriptors: *Coagulation, *Activated sludge, Sedimentation, Flocculation, Biochemical oxygen demand, Flotation, *Waste water treatment, Electrolytes, *Settling velocity.
Identifiers: *Polyelectrolytes, Coagulants, Utilization rates, Anionic, Cationic, Nonionic, Agglomeration.

Studies were conducted on 3 anionic, 6 cationic and 3 nonionic polyelectrolyte coagulants to determine their affect as coagulant aids in settling and flocculation of activated sludge. The BOD reaction rates were significantly suppressed with certain polyelectrolyte materials studied and oxygen utilization rates were not significantly affected. No one type of polyelectrolyte was found to be universally effective in increasing the agglomeration and settling rate of activated sludge but, on occasion, sufficient gas entrapment might occur to result in the flotation of sludge flocs. It was determined that polyelectrolyte coagulant aids could be useful in the solution of the settling problems encountered in many waste water treatment plants. (Ellis-Texas)
W71-05004

INDUSTRIAL WASTE TREATMENT AT TRANS WORLD AIRLINES OVERHAUL BASE,
Burns and McDonnell Engineering Co., Kansas City, Mo.
George C. Higgins.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 194-202, July 1968. 1 fig, 2 tab, 4 ref.

Descriptors: *Industrial wastes, Oil, Instrumentation, Trickling filters, Filtration, Hydrogen ion concentration, Biochemical oxygen demand, Chemical oxygen demand, *Waste water treatment, Aircraft, *Oil wastes.
Identifiers: *Metal finishing wastes, Vacuum filtration.

New waste treatment facilities under construction will be adequate in capacity to handle the existing fleet of aircraft at TWA until the jumbo jet and supersonic planes enter the fleet. There are four distinct waste streams requiring treatment from the industrial complex which comprises an overhaul facility: (1) alkaline-cyanide; (2) acid-chrome; (3) industrial-petroleum; and (4) sanitary. Two basic systems have been set up to treat petroleum wastes

and metal finishing wastes. The instrumentation necessary to control these systems, the secondary treatment facility, the tertiary treatment portion, and the sludge handling method are also discussed in this article. (Ellis-Texas)
W71-05005

REGENERATION OF HYDROCHLORIC ACID FROM WASTE PICKLE LIQUOR,
Haveg Industries, Inc., Wilmington, Del.
S. S. Spater.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 366-374, July 1968. 9 fig.

Descriptors: *Chemical wastes, Industrial wastes, Corrosion, Adsorption, Turbulence, Phenols, *Waste water treatment.
Identifiers: *Pickle liquor, *Hydrochloric acid, Sulfuric Acid, *Regeneration, Electrostatic precipitator, Turbulator.

The removal of oxide films, or scale, from metal by placing it in an acid bath is known as pickling. Formerly, spent pickle liquor was neutralized and discharged since no process for regeneration of sulfuric acid had been discovered. Increasingly stringent pollution control laws led to investigations into the applicability of hydrochloric acid in place of sulfuric acid in the pickling process. The Haveg Turbulator process is one which can regenerate hydrochloric acid from spent pickle liquor with great efficiency. This process reverses the process of producing FeCl2 from iron oxide and hydrochloric acid with: (1) a high turbulence reactor, (2) an air preheater, (3) and electrostatic precipitator, (4) an adiabatic adsorption column. This process has advantages of: (1) high reaction rates resulting in decreased space requirements, (2) high operating flexibility with very short start-up and shutdown times, (3) low maintenance requirements, (4) actual in-plant operation at present. This system presents an economical alternative to sulfuric acid pickle liquor with its versability and regeneration capability. (Lowery-Texas)
W71-05006

TREATMENT OF NON-FERROUS METAL PROCESS WASTE AT KYNOCH WORKS, BIRMINGHAM, ENGLAND,
Imperial Metal Industries (Kynoch) Ltd., Birmingham (England).
E. H. F. Stone.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 848-865, July 1968. 9 fig, 5 tab, 1 ref.

Descriptors: *Industrial wastes, Neutralization, Hydrogen ion concentration, Emulsion, Sedimentation, Sludge disposal, Filtration, *Waste water treatment, Metals.
Identifiers: Non-ferrous metal process waste, Hexavalent chromium, Polyvinyl chloride, Suspended solids, *Metal wastes.

A redrainage and effluent treatment system has been built at the Kynoch Works of Imperial Metal Industries as a result of The Rivers (Prevention of Pollution) Act of 1951. Chemical problems affecting plant design were: (1) Neutralization and pH control; (2) hexavalent chromium concentration determination and treatment; (3) oil separation; (4) sedimentation and (5) sludge disposal. It was decided to allow the effluent to flow by gravity to a central treatment plant which meant redrainage of the entire factory site with polyvinyl chloride. Neutralization was accomplished by a continuous flow system comprising a series of tanks, each pair of which form a pH control stage. After neutralization the effluent is pumped to settling tanks where suspended solids and oil separation is conducted. The sludge is dewatered by vacuum filtration and the filtrate recycled to the wet well at the end of the neutralizing tanks. The instrumentation required for pH control, flow control of lime slurries, a pH recorder, flow-metering and sampling and control of main effluent pumps. (Ellis-Texas)
W71-05007

EFFECT OF CENTRATE FROM SOLID BOWL CENTRIFIUGE ON ACTIVATED SLUDGE PROCESS,
Metropolitan Sanitary District of Greater Chicago, Ill.
Thomas J. Kennedy, and A. J. Kaplovsky.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 145-164, July 1968. 11 fig, 8 tab, 25 ref. FWPCA Demonstration Grant WPD 77-01.

Descriptors: *Centrifugation, *Metabolism, Phosphate, Nitrogen, Microorganisms, Coliforms, *Activated sludge, Chemical oxygen demand, Biochemical oxygen demand, *Waste water treatment.
Identifiers: *Sludge Volume Index, *Centrate, Volatile suspended solids, Filamentous organisms.

Two identical activated sludge pilot plants were constructed to study the effects of the recirculation of centrate from a sludge solids bowl-type centrifuge. One of the reactors received centrate, and the other was used as a control. Laboratory analysis determined that the centrate contained mainly generated fines consisting of dissolved zoogloeal masses and fragments of filamentous forms. It was also determined that primary treatment could remove the bulk of centrate solids from centrifugation installations operating at solids recoveries of at least 70%. Centrate solids, obtained from centrifugation of total waste solids output with 80% solids recovery, continuously returned to a conventional activated sludge plant produced no detrimental effects upon effluent quality or the activated sludge process itself. Consistently higher sludge volume indices were noted in the re-cycled reactor, however, but a certain limit was reached beyond which the SVI deteriorated no further. One possible explanation of this phenomena is the breakup of filamentous organisms in the centrifugation process, and their subsequent accelerated cell division and growth when placed in a biologically active reactor. (Lowry-Texas)
W71-05008

EGG LAYING HOUSE WASTES,
Steeg (Henry B.) and Associates, Inc., Indianapolis, Ind.
Charles F. Niles, Jr.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 334-341, July 1968. 1 fig, 2 tab.

Descriptors: *Farm wastes, *Confinement pens, *Forced drying, Incineration, Manure, Fertilizer, Farm lagoons, *Waste water treatment, *Waste disposal.
Identifiers: Carcasses, Laying houses.

The Berry Best Egg Company utilizes 205,000 hens in producing 11,000 dozen eggs per day. These hens produce 41,000 lbs (wet weight) of droppings and an average of 50 dead hens per day. Diposal of the wastes was attempted in a pond system, where vigorous anaerobic digestion ensued along with danger of flooding of recreational areas. Alternative methods of treatment which were investigated were: (1) solids drying; (2) controlled anaerobic digestion; (3) land disposal; (4) incineration; (5) aerobic treatment; (6) sedimentation; (7) centrifugation; and (8) hydroponic agriculture. Solids drying was selected as the optimum system for this operation. New solids collecting devices were installed to minimize the water used for collection. 40,000 gpd of water had previously been used for cleaning and solids carriage. A Badger Barn Cleaner conveyor was used to carry the wastes from a central dump station to the dryers. The solids were fed in automatically while hen carcasses were placed on by hand to equalize the load. The solids were ground in a hammermill, dryed, and either bagged for sale as fertilizer, or collected for land disposal. At the present time, the system is still in the initial shakedown period and no definite results on loadings and efficiencies have been obtained. However, it is thought that this process holds much promise for this type of operation in the future. (Lowry-Texas)
W71-05009

THE TREATMENT OF WASTE WATER FR THE CHRYSLER OUTBOARD ENGINE PLA LOCATED IN HARTFORD WISCONSI CLOSED SYSTEM,
Chrysler Corp., Detroit, Mich.
A. R. Balden.
Proceedings, Industrial Waste Conference, 22 May 2, 3, 4, 1967, Engineering Bulletin of Pur University, Vol LII, No 3, p 397-402, July 196 fig.

Descriptors: *Separation techniques, Oil, *En sions, Bentonite, Flotation, Coagulation, Co sion, Hydrogen ion concentration, Indust wastes, *Waste water treatment, Wisconsin, * wastes, Electrolytes.
Identifiers: *Polyelectrolyte, Suspended soli Outboard motors, Rubicon River, Hartford (Wis

All outboard motors produced by the Chrysler C poration Outboard Engine plant must be tested i tank to determine whether or not they are prope assembled and ready for sale. These engines run an oil-gas mixture, and an oil film builds up on surface of the test tank. To keep this oil from p manently marking the engines an emulsifier added. All other wastes streams could be econo cally handled except this one. Suspended sol content of the test tank could range as high as 10 mg/l. Because of the scarcity of cheap water it w decided that this water should be recycled throu the cooling towers and finally back to the test ta The only treatment method which could reduce t oil content, and at the same time not remove corrosion inhibitor which must be present safeguard the plant was an anionic polymer in co bination with a bentonite clay. The chemicals a added to influent which is mixed with air und pressure. The waste stream is released to a flotati tank, and as the floated floc comes to the surface is skimmed off as scum. The clarified process wa is then recycled through the plant. The quality the water is not sufficiently high to allow dire discharge to a receiving stream, but in this ca recycle is both desirable and economical. (Low Texas)
W71-05010

TREATMENT AND DISPOSAL OF EFFLUEN FROM A 450 TON PER DAY KRAFT PULP AN PAPER MILL INTO CLASSIFIED INLAN WATERS,
New Zealand Forest Products Ltd., Tokoroa.
J. L. Vickerman.
Proceedings, Industrial Waste Conference, 22n May 2, 3, 4, 1967, Purdue University, Vol LII, N 3, July 1968, p 968-982. 8 fig, 1 tab.

Descriptors: *Water purification, *Pulp and pap industry, Pulp wastes, Wood wastes, Effluents, I dustrial wastes, Sedimentation, Seepage, Soil pr perties, Soil texture, Costs, *Waste water trea ment.
Identifiers: Waikato River, New Zealand, Clarifie

Although the Kinleith Mill suffers from the disa vantage of discharging into New Zealand's longe and most utilized inland waterway, it is endowe with two natural advantages: (1) a considerab potential for purification inherent in the 360 ft. fa of the effluent stream to the Waikato River; an (2) a gopography and soil suited to a good volum of seepage disposal. To treat this effluent they hav constructed two sewer systems: (1) the stronger e fluents gravitate from the mill site through an ope channel for over a mile where they enter a sed mentation pond into a seepage pit, and then into pond for retention and controlled discharge on seasonal cycle; and (2) a system that flows throug a primary clarifier located adjacent to the mill an then discharges to a stream course which ever tually flows to Maretai Lake and classified water The operating cost per ton of pulp is about 68 cent while the unit capital cost per annual ton of pulp $4.23. (Ellis-Texas)
W71-05011

TREATMENT OF WASTES ORIGINATING FROM METAL INDUSTRIES,
Emschergenossenschaft, Essen (West Germany).
A. Montens.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 908-925. 16 fig, 1 tab, 12 ref.

Descriptors: *Industrial wastes, Metals, *Waste water treatment, Emulsions, Sedimentation, Neutralization, Ion exchange, Crystallization, Salts, Acids.
Identifiers: Cleaving, Hot-rolling-mills, Pickling plants, Regeneration, *Metal wastes.

The wastes of the metal industry, the treatment of wastes of hot-rolling-mills, of pickling plants, and the treatment of aged oil emulsions, including a short look at combustion plants were discussed. The treatment of wastes from hot-rolling-mills involves cleansing the liquid of scale and oil. This is conventionally done by mechanically cleaned settling tanks. Neutralization, ion exchange, regeneration, and crystallization were methods discussed for the treatment of pickling wastes. The treatment of oil emulsions consists of two steps: (1) the cleaving of emulsions, and (2) the separation of oil. Cleaving the oil emulsion can be done by various processes: (1) adding of salts; (2) adding of acids; (3) adding of salts and heating of the emulsions; (4) adding salts and treatment by electricity; and (5) adding of acids and organic cleaving agents. (Ellis-Texas)
W71-05012

POULTRY PROCESSING WASTE TREATMENT AT MILLSBORO, DELAWARE,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
Nelson L. Nemerow.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 526-536. 4 fig, 4 tab, 1 ref.

Descriptors: *Poultry, *Oxidation lagoons, *Organic loading, Algae, Ammonia, Sedimentation, Flotation, Biodegradation, Chlorination, Coliform, Bacteria, Biochemical oxygen demand, Delaware, *Waste water treatment.
Identifiers: Millsboro (Delaware), Swan Creek, Indian River.

9,000 to 10,000 chickens with an average weight of 3.75 lbs are processed during an 8-11 hour working day at Millsboro, Delaware. The wastes from this operation are treated in a two stage oxidation pond with effluent chlorination. Samples were collected in April, June, and December of 1966, and March of 1967. The BOD loading was found to be 1390 lbs/day, with a loading on the first pond of 935 lb BOD/acre. This pond effected a 72.5 percent reduction in BOD. The second pond had a loading of 79 lb BOD/acre, with an additional BOD reduction of 9.5% when algae are not removed from the effluent, and 70% when algae are removed. The overall removal, based on the 4 samples per year, was 92% for the filtered effluent, and 75% when the algae are not filtered out. (Lowry-Texas)
W71-05013

WASTE TREATMENT FOR AN AUTOMATED GRAY NODULAR IRON FOUNDRY,
Caterpillar Tractor Co., Peoria, Ill. Design and Construction Div.
A. J. Bader, and C. L. Meyer.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 468-476. 3 fig, 1 tab.

Descriptors: *Iron, Aeration, Sedimentation, Coagulation, Flotation, Neutralization, Weirs, Chlorination, Biochemical oxygen demand, *Waste water treatment, Illinois, Industrial wastes.
Identifiers: Mapleton (Ill), *Foundry, *Contact stabilization comminution, American Petroleum Institute Gravity Separator, Prefabrication, Lift station.

Caterpillar Tractor Company has designed a new foundry which will utilize water for cooling, dust collection, and a variety of other uses. This plant provides for separation of all difficult to treat waste streams. Oil is burned off in a 'chip dryer', and the remaining wastes are channeled into a batch unit which allows the operator the convenience of determing optimum conditions for each batch. The usual treatment is sedimentation, neutralization, and flotation. Careful control on the part of the operators is necessary in order to maintain the high effluent quality of which the equipment is capable, necessitating the employment of capable dependable operators. A detailed description of both the plant processes and the waste water treatment is included. (Lowry-Texas)
W71-05014

DISPOSAL OF EFFLUENTS FROM PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS,
Bayerische Biologische Verouchsaustalt, Munich (West Germany).
Lothar Huber.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 1009-1024. 6 fig, 3 tab, 10 ref.

Descriptors: *Oil wastes, *Oil, Activated sludge, Effluents, Separation techniques, Oily water, Oil industry, Fuels, Reclamation, Recirculated water, Hydrogenation, Aeration, Coagulation, Waste disposal, Waste water treatment.
Identifiers: *Petrochemicals, Aerated lagoons.

Full integration of in-plant procedures and multistage waste water treatment combined with re-use and reclamation of purified water at five newly constructed petroleum refineries in West Germany has led to considerable progress in pollution abatement. Use of hydrogenation processes, application of improved chemical processes, extensive use of air-cooled heat exchangers, and recirculation have decreased the water treatment and water intake of the plants. Application of pretreatment steps such as stripping, evaporation, equalization of flow, oil separation, and strength of waste waters in skim and surge tanks are practiced. Use of multi-stage biological treatment consisting of low-rate activated sludge plant and an aerated lagoon with a detention time of two days is used. Chemical coagulation can be performed in a separate unit or in the aeration tank of the activated sludge plant for added precipitation. The treatment principles developed in these refineries are being applied in the waste water treatment at a petrochemical plant. (Ellis-Texas)
W71-05015

THE LANCY INTEGRATED SYSTEM FOR TREATMENT OF CYANIDE AND CHORMIUM WASTES IN ELECTROPLATING PLANTS,
Shakespeare Co., Kalamazoo, Mich.
Neal Schreur.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 310-316. 1 fig, 1 tab.

Descriptors: *Chromium, Industrial wastes, Carbonates, Effluents, Hydrogen ion concentration, Costs, Waste water treatment.
Identifiers: Lancy Integrated System, *Cyanide, *Electroplating.

The Shakespeare Company has effectively used the Lancy Integrated System to treat their effluent from plating operations at several plants. This is not an expose on the Lancy system since this system has been reviewed in prior publications but describes the operation at Shakespeare's Kalamazoo Division. A closed loop system is used incorporating the cyanide system, the Chrome I system, and the Chrome II system. The Cyanide system is used following all cyanide bearing baths. The Chrome I system is used primarily for the reduction of hexavalent to trivalent chrome. The Chrome II system is used to polish off any remaining hexavalent chrome and to precipitate the trivalent chrome as a carbonate. (Ellis-Texas)
W71-05016

FIXED ACTIVATED SLUDGE PROCESS FOR INDUSTRIAL WASTE TREATMENT,
Kurita Central Labs., Yokohama (Japan).
K. Kato, and Y. Sekikawa.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 926-949. 17 fig, 6 tab, 14 ref.

Descriptors: *Activated sludge, *Industrial wastes, *Waste water treatment, Aeration, Sedimentation, Sludge, Domestic wastes.
Identifiers: *Fixed activated sludge process, Sludge bulking, Japan.

A series of experimental studies have been conducted to maintain a relatively constant sludge concentration by fixing the suspended flocs of activated sludge on the meshwork of plastic net panels arranged vertically in the aeration tank. This modification is used to prevent sludge bulking and is known as the 'Fixed Activated Sludge Process.' Experiments were conducted on domestic sewage, waste water discharged from a soft-drink bottling factory, and petrochemical wastes from iso-butanol and octanol plants. The FAS process is not only an improvement of the activated sludge process but is also the development of a new unit process of biochemical aeration. (Ellis-Texas)
W71-05017

COAL MINE DRAINAGE TREATMENT,
Jones and Laughlin Steel Corp., Pittsburg, Pa.
E. F. Young, Jr., and H. E. Steinman.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 477-491. 15 fig, 7 tab.

Descriptors: *Acid mine water, *Coal mine wastes, *Mine drainage, *Hydrogen ion concentration, Acidity, Alkalinity, Neutralization, Chemical precipitation, Slurries, Sedimentation, Oxidation, Hydrolysis, Iron, Water table, Pennsylvania, *Waste water treatment, Industrial wastes.
Identifiers: *Yellowboy, Hydrated lime, Holding lagoon, Jones and Laughlin Steel Corporation.

Mine drainage is an extremely variable and complex situation. Discharges analyzed here range from very alkaline to very acidic, from iron contents far beyond the allowable limits to iron contents just above the allowable limits, and so on. Realization that each situation is a separate entity and must have treatment tailored specifically for its needs is essential. Discharges, flow rates, chemical analyses, and treatment methods for several different mine drainage problems encountered by the Jones and Laughlin Steel Corporation are presented here. (Lowry-Texas)
W71-05018

WASTE CONTROL AND TREATMENT BY A CORN AND SOYBEAN PROCESSOR,
Staley (A. E.) Mfg. Co., Ill.
R. V. Willenbrink.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 517-525. 4 fig.

Descriptors: *Corn (Field), *Soybeans, Monitoring, Stabilization, Aeration, Activated sludge, *Waste water treatment, Illinois.
Identifiers: *Process wastes, Population equivalent, Contact stabilization.

Staley's program to reduce the sewer loss of materials has cost the company $150,000 per year in the past two years. Monitoring and waste treatment, two separate phases of the overall program have reduced the daily waste discharge by 50,000 population equivalents/operating day. The three basic components are: (1) careful monitoring for quick isolation of problem areas; (2) efficient waste treat-

ment for concentrated process waste; and (3) support of the management. A thorough explanation of the entire system and the managerial attitudes is included. (Lowry-Texas)
W71-05019

CENTRIFUGES FOR PAPER MILL WASTE SLUDGE DEWATERING,
Mead Corp., Chillicothe, Ohio. Central Research Lab.
W. C. Matthews, George H. Andrews, and John K. Sullins.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 325-333. 5 fig, 3 ref.

Descriptors: *Centrifugation, *Gravity, *Dewatering, Abrasion, *Pulp wastes, Flocculation, Vacuum drying, Oxidation lagoons, Biochemical oxygen demand, Waste water treatment, Ohio.
Identifiers: *Clarification, *Recovery, Hydraulic loading, Detention time, Cyclone cleaner, Suspended solids, Fly ash, Bar screen, Grinder.

Centrifuges have been previously used successfully in the paper industry for solids concentration. They have been used by The Mead Corporation both for dewatering and for recovery of materials such as lime. Solids recovery and discharge solids are functions of: (1) character of the waste, (2) the feed rate, (3) the feed consistency, (4) pond depth, and (5) bowl speed. Feed rates of up to 300 gpm have been handled without flooding, with the optimum being approximately 100 to 150 gpm. Sludge cake averages 40% solids, with solids recovery approaching 90% of the feed. Suspended solids and BOD removals are in excess of 80% and 40% respectively. Problems have been encountered from the standpoint of longevity of the equipment. Grit and fly ash tend to produce excessive wear at speeds for which the centrifuges were designed. Reduction of centrifuge speed necessarily reduces the efficiency of the operation as a whole. Future developments in the field may include new materials used for their wear resistant properties, pretreatment by cyclone cleaners for abrasive removals, or centrifuges in series, each one operating at successively higher speeds causing the abrasive materials to be removed at the slow speeds with a minimum of equipment wear. (Lowry-Texas)
W71-05020

THE DU PONT WASTE LIQUOR PROCESS,
du Pont de Nemours (E. I.) and Co., Wilmington, Del. Industrial and Biochemicals Dept.
Ralph Aarons, and Robert A. Taylor.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 120-125. 5 fig, 1 tab.

Descriptors: *Industrial wastes, *Waste water treatment, *Lime, Steam, Air, Temperature, Hydrogen ion concentration, Gypsum, Waste disposal, *Neutralization, *Oxidation, Iron compounds, Delaware.
Identifiers: Pickle, Waste pickle liquor process, Magnetite.

The problem of disposal of waste liquor produced when sulfuric acid is used to clean, or 'pickle' steel has been solved by the du Pont Company. This process involves continuous neutralization with lime and sinultaneous oxidation of soluble iron to insoluble magnetic iron oxide which provide high-density, low-volume granular solids which are easily separated and disposed of. Gypsum is also produced by this process and has been preliminarily evaluated by a leading manufacturer of wall board and found to be useable. This process is in operation at two steel mills with several more units in the design or construction stage. (Ellis-Texas)
W71-05021

FLUIDIZED-BED PROCESSES - A SOLUTION FOR INDUSTRIAL WASTE PROBLEMS,
Copeland Process Corp., Oak Brook, Ill. Engineering Dept.
John E. Hanway, Jr.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 183-193. 10 fig, 1 tab.

Descriptors: *Industrial wastes, *Pulp and paper industry, Steel, Effluents, Water pollution, Air pollution, Incineration, *Oxidation, *Waste water treatment, Illinois.
Identifiers: *Fluidized-bed process, *Copeland process.

The successful application of the Copeland Process to the treatment of waste effluents from the paper and pulp industry to eliminate stream pollution is described and additional applications have been outlined. Fluidized-Bed Processes represents not only a method to prevent stream pollution, but also a treatment which allows for possible substantial and economic recovery of pulping chemicals. Any waste product containing a combustible constituent represents a promising candidate for the fluidized-bed process. Oxidative processes, by combustion as in the fluidized-bed processes, convert pollution-causing constituents of our wastes into innocuous gases and inert solids which do not cause water or air pollution. (Ellis-Texas)
W71-05022

OAHU WASTE WATER TREATMENT PLANT EFFICIENCY,
Hawaii Univ., Honolulu. Dept. of Environmental Health and Sanitary Engineering.
Reginald H. F. Young, and P. L. Chan.
Journal Water Pollution Control Federation, Vol 42, No 12, December 1970, p 2052-2059. 5 tab, 7 ref.

Descriptors: *Hawaii, *Waste water treatment, Activated sludge, Trickling filters, Chlorination, Disinfection, Lipids, Phosphorus, Nitrogen, Biochemical oxygen demand, Hydrogen ion concentration, Temperature, *Treatment facilities, Hawaii.
Identifiers: *Extended aeration, Suspended solids, Septicity, Oahu (Hawaii).

Waste treatment plants in Hawaii are currently employing primary and primary plus secondary treatment in the form of either trickling filters or activated sludge. Suspended solids removals, BOD5 removals and chlorine residuals all fall with the operational percentage limits reported by other authors for trickling filters and activated sludge and chlorination. At present, there are no facilities for either nitrogen or phosphorus removal, the excess of which is discharged to the effluent. (Lowry-Texas)
W71-05023

PROCURING THE DESIGN DATA IN ORDER TO UPRATE AND OPTIMIZE THE OPERATION OF AN INDUSTRIAL WASTE TREATMENT FACILITY,
American Cyanamid Co., Bound Brook, N.J. Organic Chemicals Div.
James R. Grube.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, July 1968, p 241-251. 3 fig, 3 tab.

Descriptors: *Aeration, *Diffusion, *Industrial wastes, Activated sludge, Pilot plants, Oxygen, Dissolved oxygen, Biochemical oxygen demand, Optimization, Pressure, Oxygenation, *Waste water treatment, *Treatment facilities, New Jersey.
Identifiers: Surface aerators, Diffused air, Bound Brook (NJ).

A program was initiated by the American Cyanamid Company to update their treatment facilities since increased organic loading and hydraulic flow coupled with higher state standards made their treatment plant outdated. A three part program, was initiated to procure the design data uprate and optimize the secondary treatment faci ties which included: (1) activated sludge pilot pla studies to ascertain the feasibility of obtaining t degree of treatment required; (2) small and lar scale test work to determine the additional oxyg requirement in the aeration system; and (3) t selection and process design of the aeration equi ment for supplying this additional oxygen to t aeration system. (Ellis-Texas)
W71-05024

USE OF STYROFOAM FOR TRICKLIN FILTER COVERS,
Dow Chemical Co., Midland, Mich. Plastics Dept.
J. P. Sheahan.
Proceedings, Industrial Waste Conference, 20t May 4, 5, 6, 1965, Purdue University, Vol XLI No 4, July 1965, p 572-582. 11 fig, 2 tab.

Descriptors: *Trickling filters, Odor, Fog, Freez ing, Roofs, Construction, Costs, Aesthetic *Waste water treatment, Biochemical oxygen d mand, Michigan.
Identifiers: *Styrofoam, *Spiral generatio Midland (Mich).

A comparison of the efficiencies of covered versu uncovered trickling filters was made by the Do Chemical Company. It was found that there wa some increase in efficiency but not enough to justi fy covering the trickling filters. Other advantages t covering trickling filters are prevention of freezing odor control, fog control, lessen the spread of filte flies, and improve appearance. The main disad vantage to covering a trickling filter is the excessiv cost which is in the range of $2.75-5.00 per squar foot of plan area. (Ellis-Texas)
W71-05025

THE EFFECT OF VARYING AMOUNTS AN RATIOS OF NITROGEN AND PHOSPHATE ON ALGAE BLOOMS,
Academy of Natural Sciences of Philadelphia, Pa Dept. of Limnology.
For primary bibliographic entry see Field 05C.
W71-05026

UTILIZATION OF RESISTANT PROTEINS BY ACTIVATED SLUDGE,
Seattle Metropolitan Municipality, Wash.
George J. Capestany, and Dale A. Carlson.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, March 1966, p 943-952. 8 fig, 11 ref.

Descriptors: *Proteins, *Aminoacids, *Biodegradation, Protozoa, Rotifers, Pre-Treatment (Water), Colorimetry, Chromatography, Oxidation, Carbon, Nitrogen, Microorganisms, *Activated sludge, Waste water treatment, Washington.
Identifiers: *Keratins, Hair, Disulfide bonds, Flagellates, Amoebas, Sodium hydroxide, Seattle (Wash).

Protein from mammalian hair, hooves and nails, bird feathers, and reptile scales all falls within the general classification of keratins. Keratins are insoluble in hot water, organic solvents, dilute bases and acids, and are resistant to digestion by pepsin and trypsin. Keratin has a high sulfur content in the form of disulfide bonds, forming a dihedryl bond angle of 90 deg and having a bond energy of 60 k cal/mole. To prepare the keratin for testing, it was dissolved in sodium hydroxide to make it available to the microorganisms for biodegradation, sodium hydroxide being tested against other solvents and found to be the best. Results showed considerable variation in the types of microorganisms which were present under different loadings of keratin, but they also showed conclusive evidence that keratin could feasibly be biologically degraded. (Lowry-Texas)
W71-05027

'AEROBIC AND AEROBIC LAGOON TREAT-ENT OF PACKING PLANT WASTES,
nley Associates Engineering, Ltd., Edmonton lberta).
R. Stanley.
ceedings, Industrial Waste Conference, 21st, y 3, 4, 5, 1966, Purdue University, Vol L, No 2, rch 1966, p 275-283. 2 fig, 3 ref.

scriptors: Lagoons, *Anaerobic conditions, robic conditions, Industrial wastes, Odor, Scum, aste water treatment, *Oxidation lagoons.
ntifiers: *Packing plant wastes, Edmonton, nada.

examination was conducted of the development l operation of facilities constructed at Edmon-, Canada which utilized anaerobic lagoons fol-ed by aerobic or storage lagoons. Operating dif-lties included: (1) a high hydrogen sulfide duction which caused odor and corrosion, and scum accumulation. Anaerobic lagoons can vide economical and efficient treatment of meat king wastes under sub-zero weather conditions. luent from anaerobic lagoons treating meat king plant wastes has been stored during winter nths and discharged in the spring without caus-an odor nuisance. (Ellis-Texas)
1-05028

TERMINATION OF PROTEIN IN WASTE TER,
as Western Coll., El Paso. Dept. of Civil En-eering.
primary bibliographic entry see Field 05A.
1-05029

E TREATMENT OF REFINERY WASTE TER WITH PARTICULAR CONSIDERA-ON OF PHENOLIC STREAMS,
rman Shell Co., Hamburg (West Germany).
helm Steck.
ceedings, Industrial Waste Conference, 21st, y 3, 4, 5, 1966, Purdue University, Vol L, No 2, rch 1966, p 783-790. 2 tab.

scriptors: *Oil wastes, Oil, *Phenol, Ammonia, salination, Separation techniques, Flocculation, tation, Brines, Biological treatment, Gasoline, ors, Explosions, Biochemical oxygen demand, aste water treatment.
ntifiers: *Refineries, Catalytic cracker, Gas pping, Re-use, Hamburg, West Germany, Lye.

rcity of land in the highly industrialized Europe-country of West Germany has necessitated the struction of petrochemical complexes im-diately adjacent to or within heavily populated as. In view of this fact, increasingly strict air and er pollution laws have been necessary. The rochemical industries have responded to this ation with a concentrated effort to: (1) reduce volume of water used; (2) find ways of re-using er from various processes in other processes; (3) segregate the waste streams so that each te may be treated in the most efficient manner sible. The areas of greatest effort deal mainly n waste oil and phenols and the methods used in oving or destroying them. The methods used include gravity separation of oil, flotation/floc-ation, and finally biological treatment. (Lowry-as)
1-05030

ERGY, TOTAL CARBON, AND OXYGEN MAND,
e Univ., Houston, Tex. Dept. of Chemical En-eering.
primary bibliographic entry see Field 05A.
1-05031

E COMBINED TREATMENT OF TROCHEMICAL WASTES, GASIFICATION ASTES, AND FISCHER-TROPSCH SYNTHES-WASTES,
th Africa Coal, Oil and Gas Corporation, Sasol-g (South Africa).
P. R. Loewenstein, and W. P. De Waal.
Proceedings Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 480-494, March 1966. 4 fig, 3 tab, 1 ref.

Descriptors: *Chemical wastes, Sewage, Permits, Flocculation, Filters, Coagulation, Alkalinity, Oil Biochemical oxygen demand, Phosphate, Effluents, *Oil wastes, *Waste water treatment, Costs, Treatment facilities, Standards.
Identifiers: Petrochemical wastes, Gravity separator (API), Latex, Butadiene, Styrene, Ethylene, Gas wastes, South Africa, *Treatment standards, *Combined treatment.

Segregation of storm water and spent cooling water from oil polluted waste streams has significantly reduced treatment costs and increased plant efficiency for a South African Petrochemical Plant. The addition of flocculation facilities has greatly enhanced treatment efficiency in the case of oil and latex polluted waters. A complete description of the geographical location sewer systems, primary and secondary treatment facilities, and effluent discharge constraints is presented. At present, this complex is operating within or nearly within the governmental constraints, but increasingly higher effluent quality standards may soon necessitate further updating of, and addition to the treatment facilities. (Lowry-Texas)
W71-05032

THE EFFECT OF NITRIFICATION OF ORGANIC WASTES ON WATERS IN THE NATURAL ENVIRONMENT-I. EFFECTS OF SEED,
Maine Univ., Orono. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-05033

SODIUM HYDROXIDE RECOVERY IN THE TEXTILE INDUSTRY,
Buenos Aires Univ. (Argentina).
Carlos S. Carrique, and Luis U. Jauregui.
Proceedings Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 861-868, March 1966. 4 fig, 1 tab.

Descriptors: *Textiles, *Industrial wastes, Hydrogen ion concentration, Alkalinity, Color, Turbidity, Filtration, Sedimentation, Flotation, Evaporation, Waste water treatment, *Water reuse, Sodium compounds, Costs, Evaporators.
Identifiers: Castelar Textile Mill, Caustic soda, Concentration, Dyeing, Bleaching, Desizing, Mercerizing, Buenos Aires, Argentina, *Sodium hydroxide, *Recovery costs.

High treatment costs for sodium hydroxide effluents, and high replacement costs for sodium hydroxide itself necessitated construction of a system to segregate the sodium hydroxide waste stream and reclaim the sodium hydroxide. This decision was made by an Argentine textile mill, and it resulted in decreased chemical costs both for alum coagulation and neutralization, and it was more economical to reclaim the sodium hydroxide than to replace it. The total net gain is approximately 35 to 40 thousand U. S. dollars per year for a firm handling about 2000 metric tons of cotton per year. The system devised consists of evaporative concentration combined with filtration. Problems were encountered in the original single effect system because the recovered product had a strong color and could not be used for recycle. Also, the use of caustic soda in the plant occasioned many corrosion problems. The addition of a second evaporator, working under a vacuum, made the process a double effect evaporator, and provided both more complete and more efficient treatment of the caustic soda solution. This unit provided re-use of heat from the single effect evaporator, permitted the collection of sodium hydroxide free of color, and avoided the serious corrosion problems. (Lowry-Texas)
W71-05034

REMOVAL OF COD FROM WASTE WATER BY FLY ASH,
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Prodip K. Deb, Alan J. Rubin, Arthur W. Launder, and K. H. Mancy.
Proceedings Industrial Waste Conference, 21st, May 3, 4, 1966, Purdue University, Vol L. No 2, p 848-860, March 1966. 9 fig, 12 ref.

Descriptors: *Adsorption, *Fly ash, *Activated carbon, Feasibility studies, Pilot plants, Coagulation, Sedimentation, Separation techniques, Hydrogen ion concentration, Biochemical oxygen demand, *Chemical oxygen demand, Ohio, Waste water treatment.
Identifiers: *Refractory materials, Coagulant, Teflon, Hamilton County (Ohio).

Much research on adsorption has been performed recently with activated carbon. However, because of the excessive cost and lack of regeneration procedures for activated carbon, much interest has been developed in a cheaper adsorbent. A comparison of activated carbon versus fly ash, a disposal problem for many coal burning industries, was conducted. The adsorptive properties of activated carbon are far superior to any other commercially available adsorbent, but economic analyses showed that while initial capital costs would be 15% greater, largely due to increased thickener sizes, the long term operating costs for the fly ash plants would be approximately 1/7 of the cost of activated carbon. The capacity of fly ash to remove refractory materials both in batch and continuous flow systems was well demonstrated in this study. The three major system parameters, mixing time, initial COD, and concentration of fly ash were logarithmically related to COD removal. The addition of a small amount of activated carbon significantly enhanced the adsorptive capacity of the mixture. Further studies should be made on a much larger scale to adequately determine the feasibility of fly ash utilization, with respect to its adsorptive capacity, and also the disposal problems associated with the fly ash sludge. (Lowry-Texas)
W71-05035

CONTROL OF WATER AT STRIP MINING OPERATIONS THROUGH SOUND MINING AND RECLAMATION PRACTICES,
Peabody Coal Co., St. Louis, Mo. Forestry and Water Quality.
For primary bibliographic entry see Field 05G.
W71-05036

PLATING AND INDUSTRIAL WASTE TREATMENT AT THE FISHER BODY PLANT,
General Motors Corp., Warren, Mich. Fisher Body Div.
Raymond Fisco.
Water and Sewage Works, 1970 Reference Number, Vol 117, p R236-239, November 28, 1970. 4 p, 4 fig.

Descriptors: *Waste water treatment, *Industrial wastes, *Industrial water, *Water management (Applied), *Lake Erie, Methodology, Planning, Chromium, Water pollution, Streams, Sludge treatment, Acids, Alkalinity, Neutralization, Treatment facilities, Water quality, Water utilization, Chemicals, Reclaimed water, Effluents.
Identifiers: *Fisher Body (Elyria, Ohio plant).

The Fisher Body, Elyria, Ohio plant is a major manufacturer of hardware and electroplated parts for the automobile industry. The treatment plant effluent now averages 1.5 mgd. This discharges into a large storm sewer which in turn joins the Black River one mile east of the plant and is approximately one-fourth mile upstream from Cascade Park. Inasmuch as the Fisher Body effluent flows to a surface stream, the plant is required to operate under the provisions of a permit from the Ohio Water Pollution Control Board at Columbus. The raw waste flow may be described as rather weak solutions of acid or alkali and various suspensions incidental to this type of manufacturing. The flow-through ver-

sus batch-type waste treatment is compared. The importance of segregation of the various types of wastes is emphasized. The flue gas method of chrome waste scrubbing has proven highly effective at this plant. Surveillance and continuous monitoring are likewise extremely important. A valuable adjunct to the system is an aquarium receiving flow from the final effluent stream. (Woodard-USGS)
W71-05085

PROCESS CONTROL TECHNIQUES FOR TREATING ACID MINE-POLLUTED WATERS,
Battelle Memorial Inst., Columbus, Ohio. Environmental Systems Div; and Battelle Memorial Inst., Columbus, Ohio. Chemical Process Development Div.
Syed R. Qasim, Ira L. Whitman, and Robert F. Testin.
Water and Sewage Works, 1970 Reference Number, Vol 117, p R240-R245, November 28, 1970. 6 p, 6 fig, 3 tab, 7 ref.

Descriptors: *Waste water treatment, *Acid mine water, *Industrial wastes, *Appalachian Mountain region, *Water management (Applied), *Industrial water, Mine drainage, Mining, Water pollution, Streams, Mine wastes, Chemicals, Methodology, Water quality, Reclaimed water, Effluents, Acids, Neutralization, Alkalinity, Ion exchange, Chemical analysis, Data collections, Surface waters.

The generalized curves and procedure presented in this paper can be applied to control the chemical feed rates and regeneration cycle of the ion-exchange resin beds in various treatment processes in municipal and industrial water treatment plants which process acid mine polluted waters. The procedure is quite simple since pH and specific conductance are the only parameters required for applying the curves developed in this paper. These can be monitored continuously, thereby eliminating the need for frequent chemical tests to adjust the chemical feed rates. The process of adjusting the chemical feed rates and resin beds regeneration cycle can be computerized, giving a completely automated system. (Woodard-USGS)
W71-05086

BACTERICIDAL EFFECTS OF ALGAE ON ENTERIC ORGANISMS,
Texas Univ., Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 05C.
W71-05155

INVESTIGATION OF A HIGH-PRESSURE FOAM WASTE WATER TREATMENT PROCESS,
Garrett Research and Development Co., Inc., La Verne, Calif.
James K. P. Miller, and L. Karl Legatski.
Copy available from GPO Sup Doc as I67.13/4:17030 ESX 04/70, $0.45; microfiche from NTIS as PB-197 863, $0.95. Water Pollution Control Research Series 17030 ESX 04/70, April 1970. 9 p, 12 tab, 10 fig. FWQA Program 17030 ESX.

Descriptors: *Distillation, *Flotation, *Separation techniques, Saturation, Coagulation, Pressure, Phosphates, Turbulence, Turbidity, Dissolved oxygen, Chemical oxygen demand, Biochemical oxygen demand, Pilot plant, Biodegradation, *Waste water treatment.
Identifiers: *Soluble organics, Particulates, Alum, Ferric chloride, Suspended solids.

The technical and economic feasibility of the separation of organic materials and other contaminants from primary and secondary sewage effluent by a foam fractionation-flotation process was studied. Air-waste water mixtures were held at pressures above 150 psi for from 6 to 25 minutes and then bled to a release vessel where pressures were reduced to atmospheric. Soluble organic and particulate matter collected at the bubble-water interfaces of the fine bubbles being evolved from the supersaturated liquid. Effects of varying flow rate, pressure, contact time, and of different release vessels and additives were studied. 70%, 90%, and 40-80% reductions of COD, phosphates, and suspeneded solids were effected at optimum conditions of air-to-water volume ratios of 2.17 to 1, pressures greater than 175 psi, and with 300-400 mg/l alum or ferric chloride as coagulants. Estimated costs, exclusive of chemicals were 5 cents/1000 gallons for a 10 mgd plant. (Lowry-Texas)
W71-05156

GRANULAR CARBON TREATMENT OF RAW SEWAGE,
FMC Corp., Princeton, N.J.
C. B. Hopkins, W. J. Weber, Jr., and J. Bloom, Jr.
Copy available from GPO Sup Doc as I67.13/4:OPD.17050 DAL 05/70, $1.00; microfiche from NTIS as PB-197 864, $0.95. Water Pollution Control Research Series OPD-17050 DAL 05/70, May 1970. 83 p, 14 tab, 34 fig, 20 ref. FWQA Program 17050 DAL.

Descriptors: *Activated carbon, *Chemical treatment, Coagulation, Sewage treatment, Pilot plant, Adsorption, Biochemical oxygen demand, *Waste water treatment.
Identifiers: *Clarification, Expanded-bed, Packed-bed, Total organic carbon.

A comparison was made of expanded-bed and packed-bed modes of operation of activated carbon adsorption systems in the direct physico-chemical treatment of raw sewage and primary effluent. This project involved extended field testing of a pilot scale treatment system of chemical clarification followed by adsorption. The expanded-bed and packed-bed modes of operation demonstrated essentially equivalent removal of organic matter from the chemically clarified effluent. When a 24 ft. settled depth of activated carbon was used, both systems consistently produced a clear, treated water with an average organic content of only 3-5 mg/l, measured either as TOC or BOD. The expanded bed mode offered several advantages: (1) it eliminates plugging or fouling with particulate matter and air binding; (2) feed pressure remains constant and maintenance requirements are minimal; and (3) it provides an opportunity for a degree of natural aeration. Estimated cost for treating raw waste water in a 10 MGD plant by this process is about 20 cents per 1000 gal. with a total estimated investment of $4,000,000.(Ellis-Texas)
W71-05157

ULTRAFILTRATIVE DEWATERING OF SPENT POWDERED CARBON,
Amicon Corp., Lexington, Mass.
C. W. Desaulniers, and R. W. Hausslein.
Copy available from GPO Sup Doc as I67.13/4:ORD17020 DBA 03/70, $0.70; microfiche from NTIS as PB-197 865, $0.95. Water Pollution Control Research Series, ORD 17020 DBA 03/70, March 1970. 68 p. FWQA Program 17020 DBA.

Descriptors: *Membranes, *Dewatering, *Activated carbon, *Slurries, Shear, Flocculation, Pressure, Separation techniques, Solids content process, Cost analysis, Tertiary treatment, *Waste water treatment.
Identifiers: *Ultrafiltration, Flux, Secondary effluent, Polyelectrolytes.

Spent powdered activated carbon from secondary effluent treatment has been successfully dewatered by continuous membrane ultrafiltration. 5 and 10% carbon solids concentration slurries, using a laboratory size thin channel (0.1 sq ft membrane area), have been dewatered by continuous ultrafiltration to solids levels of 25 to 30%. Dewatering rates ranged between 50 and 100 gal/sq ft per day transmembrane pressures of from 10 to 50 psi during runs as long as 9 days, and product water was invariably free of any syspended carbon solids. T cost of membrane ultrafiltration depends upon membrane life, and at membrane flux rates of gal/sq ft per day the cost of dewatering carbon fr 10 to 20% solids is $0.0015 per pound of carb with a membrane life of six months, and $0.00 per pound with a membrane life of only one mon At the present no conclusive data on membrane is available, but estimates of between 1 and months are quite common and seen to be reasor ble. (Lowry-Texas)
W71-05158

DISPOSAL OF TITANIUM DIOXIDE WASTE A STRATIFIED ESTUARY,
Norsk Institutt for Vannforskning, Blindern.
Terje Limensen, and Paul Liseth.
Proceedings, Industrial Waste Conference, 22 May 2,3,4, 1967, Purdue University, Vol LII, No July 1968, p 950-967. 15 fig, 2 tab, 5 ref.

Descriptors: *Titanium, *Industrial wast *Stratification, *Estuaries, Diffusion, Trace Acidity, Turbidity, Hydrogen ion concentratio *Waste disposal, Waste water treatment.
Identifiers: *Titanium dioxide, Glomma Riv Rhodamin B.

Laboratory experiments established values for t dilution of titanium dioxide before it was dump into the Glomma River in Norway. Jet diffusio and additional horizontal diffusion in the subst face layer during the downstream transport we attained. Acidity, turbidity, and precipitation ferrous iron as hydrous ferric oxide were used parameters to prevent pollutional effects in t river. In the effluent station the waste is mixed wi freshwater from the river to obtain a predete mined density level in the mixture, dispos through diffusers at the bottom of the salt wedg and enclosed into the brackish water layer by diffusion for downstream transport. An efficien survey using Rhodamin B as a tracer was co ducted and indicated that the system was operati as intended. (Ellis-Texas)
W71-05159

ORGANIC POLYMERS IN THE TREATMEN OF INDUSTRIAL WASTES,
Nalco Chemical Co., Chicago, Ill.
John T. Burke, and M.T.Dajani.
Proceedings, Industrial Waste Conference, 21s May 3,4,5, 1966, Purdue University, Vol L, No March 1966, p 303-313. 6 fig, 3 ref.

Descriptors: *Coagulation, *Flocculation, *Co loids, Zeta potential, Mobility, Stabilization, A sorption, Reclamation, *Industrial wastes, D watering, Waste disposal, *Waste water treatment
Identifiers: *Polymers, Thickener, Clarifier.

Polymer flocculants and emulsion breaking chem cals are versatile, but not universal. The individu situation must be considered to determine whethe such treatment is both applicable and economica Advantages of this type of treatment are: (1) rela tively simple lab tests or pilot plant test can be use to determine feasibility; and (2) plant result generally follow the pilot plant results to a great ex tent. The mechanisms of the process, and tests fo the feasibility of this treatment method ar presented here. Several applications in differen situations with different wastes are also discussed (Lowry-Texas)
W71-05160

EQUALIZATION OF LIQUID WASTES,
Newark Coll. of Engineering, N.J. Dept. of Civi Engineering.
Ivan Metzger.
Proceedings, Industrial Waste Conference, 21st May 3,4,5, 1966, Purdue University, Vol L, No 2 March 1966, p 338-347. 7 fig, 13 ref.

Descriptors: *Liquid wastes, Industrial Wastes *Weirs, Toxicity, Dye releases, Baffles, *Waste water treatment, Settling.

dentifiers: Equalization, Slug, Continuous flow reatment.

A rational approach to the design and construction of equalization tanks for continuous flow treatment vas developed by laboratory experimentation. A riangular shaped tank with a weir along one side vas proposed and compared with an ideal settling ank. A toxic slug was more efficiently equalized in he triangular shaped tank since a portion of the lug is continuously removed while in a rectangular ettling tank all of the slug leaves the tank at essenially the same time. (Ellis-Texas)
W71-05161

A RATIONAL APPROACH TO AN INDUSTRIAL WATER POLLUTION CONTROL PROGRAM,
Minnesota Mining and Manufacturing Co., St. Paul.
oseph T. Ling, and Charles E. Kiester.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, March 1966, p 314-321. 12 ref.

Descriptors: *Water pollution control, *Industrial vastes, Waste water treatment, Pollution abatement, Pilot plants, Industrial plants.

Reduction of the pollution load through various easible means is the first step in approaching an industrial waste water pollution control program and ncludes: (1) plant site selection; (2) waste reduction program; (3) waste survey; (4) waste treatment program; (5) pilot plant study; (6) construction and operation; and (7) continuous monitoring nd evaluation. (Ellis-Texas)
W71-05162

EXTREME REMOVALS OF SUSPENDED SOLIDS AND BOD IN TANNERY WASTES BY COAGULATION WITH CHROME TAN DUMP LIQUORS,
Maine Univ., Orono. Dept. of Civil Engineering.
O. J. Sproul, K. Keshavan, and R. E. Hunter.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, March 1966, p 600-612. 5 fig, 4 tab, 8 ref.

Descriptors: *Biochemical oxygen demand, *Coagulation, Lime, Sulfides, Water utilization, *Waste water treatment.
Identifiers: *Tannery wastes, *Suspended solids.

Design criteria was developed for a treatment plant for a chrome tanned cattleskin tannery waste that maximized the removal of suspended solids in addition to BOD removal. A change from the dehairing process utilizing a high lime sulfide to one using a proprietary unhairing compound with less lime and sulfide reduced the total plant BOD and suspended solids by 25 and 45%, respectively. Tests on the plant as it was before and after modification revealed that equalization of plant flows and utilization of the coagulating action of chrome dump wastes gave SS and BOD removals of up to 99 and 50%, respectively, after settling of the waste. (Ellis-Texas)
W71-05163

THE ROLE OF PHOSPHATE IN THE ACTIVATED SLUDGE PROCESS,
Ontario Research Foundation, Toronto. Dept. of Applied Microbiology.
Lorne A. Campbell.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, March 1966, p 214-225. 2 fig, 6 tab, 12 ref.

Descriptors: *Phosphates, *Activated sludge, *Sewage, *Microorganisms, Flocculation, Biological oxidation, *Waste water treatment.
Identifiers: Dispersed growth, Canning wastes, Milk wastes, Metabolites.

An investigation was made of why activated sludge functions as it does. The fact that it does function is an anomoly and is an apprent contradiction of the theory of catalysis. Experimental studies of the effect of yeast extract, glucose, urea, phosphate, amino acids, glutamate, and trace nutrients on dispersed growth of sewage microorganisms were conducted. The results of this study explains why a difficulty is experienced in treating milk plant wastes and vegetable canning plant wastes by orthodox activated sludge procedures. This study, in conjunction with other substantiating research, permits the postulation of the following hypothesis: activated sludge flocs function as reservoirs of metabolites essential to dispersed growth of sewage microorganisms. (Ellis-Texas)
W71-05164

SPRAY IRRIGATION-A POSITIVE APPROACH TO PERPLEXING PROBLEM,
Oxford Paper Co., West Carrolton, Ohio.
W. A. Flower.
Proceedings, Industrial Waste Conference, 20th, May 4,5,6, 1965, Purdue University, Vol XLIX, No 4, July 1965, p 679-683.

Descriptors: *Irrigation, Biochemical oxygen demand, Toxicity, Aquifers, Hydrogen ion concentration, Organic matter, *Water reuse.
Identifiers: *Spray irrigation, Howard Paper Mills.

After two years of pilot plant trials and tribulations, enough knowledge was gained so that a full scale installation was warranted. Many questions had to be answered before a permanent installation was installed which included: (1) what cover crop was most suitable; (2) land requirement; (3) supervision needed; (4) how much water could be applied; (5) what is the tolerance of the cover crop to waste materials; (6) would groundwater become polluted; and (7) disposition of the cover crop. 100% treatment of wastes from the Howard Paper Mills during the low flow season will be provided by a 117 acre spray irrigation system. (Ellis-Texas)
W71-05165

EXTENDED AERATION ACTIVATED SLUDGE TREATMENT OF PETROCHEMICAL WASTE AT THE HOUSTON PLANT OF PETRO-TEX CHEMICAL CORPORATION,
Petro-Tex Chemical Corp., Houston, Tex.
R. D. Pruessner, and J. Mancini.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, March 1966, p 591-599. 3 fig, 3 tab, 10 ref.

Descriptors: *Activated sludge, *Aeration, Pilot plants, Costs, Anaerobic conditions, Sludge, Biochemical oxygen demand, Chemical oxygen demand, *Oil wastes, *Waste water treatment, Oxidation lagoons, Texas.
Identifiers: Extended aeration, Suspended solids, Volatile suspended solids, Houston (Tex).

Laboratory units consisting of continuous flow activated sludge units to provide a rapid evaluation of gross loading and toxicity information, and batch temperature studies were conducted. Two pilot plants consisting of a conventional activated sludge and an extended aeration activated sludge unit were also operated to provide a basis for our final waste treatment plant design. The extended aeration activated sludge treatment unit proved to be the most efficient and removes about 99% of the BOD from the waste stream in a stable system which requires about 3 hours per day operator time. It was also found that the use of an anaerobic pond is an economical method of sludge disposal. (Ellis-Texas)
W71-05167

EFFECT OF ORGANIC WASTE WATER AND COOLING WATER ON SELF-PURIFICATION OF WATER,
Technische Hochschule, Aachen (West Germany).
Botho Bohnke.
Proceedings, Industrial Waste Conference, 22nd, May 2,3,4, 1967, Purdue University, Vol LII, No 2, July 1968, p 752-770. 23 fig, 20 ref.

Descriptors: *Cooling water, *Waste water treatment, *Self-purification, Aeration, Reaeration, Water purification, Industrial wastes, Oxygenation, Organic wastes, Organic loading.
Identifiers: *Lippe River, Lippe Association, Lippeverband, Artificial aeration.

A discussion of the problems involved in the reoxygenation of the Lippe River in West Germany is presented. Analyses of oxygen diagrams at a given load showed that the influence of biologically degradable industrial waste water and the discharge of cooling water exerted on the self-purification capacity of the Lippe River can be estimated with satisfactory accuracy for long stretches of the river. The method of calculating the influence of organic loads on the process of self-purification has proved a valuable help in establishing economical improvement schemes in specific treatment measures, and in fixing contributions. An artificial aeration system was used to maintain the biological balance of this river until adequate treatment facilities could be constructed. (Ellis-Texas)
W71-05168

EFFECTS OF REFRIGERATED STORAGE ON THE CHARACTERISTICS OF WASTE,
San Jose State Coll., Calif. Dept. of Civil Engineering and Applied Mechanics.
F. J. Agardy, and M. L. Kiado.
Proceedings, Industrial Waste Conference, 21st, May 3,4,5, 1966, Purdue University, Vol L, No 2, March 1966, p 226-233. 3 fig, 3 tab, 8 ref. Public Health Service Training Grant 1T1-WP-66-02.

Descriptors: *Refrigeration, *Cooling, *Freezing, Preservation, Water analysis, Storage, Chemical oxygen demand, Biochemical oxygen demand, Respiration, Waste water treatment.
Identifiers: Warburg respirometer, Suspended solids, Volatile suspended solids.

Studies were initiated to determine the effect of refrigerated storage, freezing, and the length of storage under these conditions on standard analyses carried out on wastes. Total solids, suspended solids, volatile suspended solids, COD and BOD were measured at time equals 0, 1 day, and 7 days and only the total solids concentration remained uneffected. A large increase in suspended solids and volatile suspended solids as a result of freezing is a clear indication of the colloidal nature of many waste constituents. A Warburg respirometer was used to investigate the changes in BOD rate constants and ultimate first stage BOD values. (Ellis-Texas)
W71-05169

MODEL OF THE COMPLETELY-MIXED ACTIVATED SLUDGE PROCESS,
Texas Univ., Austin. Dept. of Civil Engineering.
Tom D. Reynolds, and J. T. Yang.
Proceedings, Industrial Waste Conference, 21st, March 1966, Purdue University, Vol L, No 2, March 1966, p 696-713. 8 fig, 7 tab, 6 ref.

Descriptors: *Activated sludge, Respiration, Sludge, *Sewage treatment, *Waste water treatment.
Identifiers: Complete mix, Recycle, Continuous flow, Endogenous respiration, Sludge yield.

A laboratory model was operated to determine the design parameters involved in a completely mixed activated sludge process. The data from the continuous flow unit without recycle fitted the straight line forms of the equations developed which indicated that the equations derived in this study were correct. Equations were developed for MLVSS concentration, the detention time required, the oxygen uptake rate, and an adjustment to laboratory endogenous respiration rates. The design parameters of the sludge yield coefficient and the endogenous respiration rate can be determined from continuous flow laboratory units without recycle or from batch laboratory units using parent sludge from a continuous flow activated sludge unit. The batch tests are to be

preferred because these tests are much quicker and accurate results are obtained from batch tests with much less difficulty than from the continuous flow tests without recycle. (Ellis-Texas)
W71-05171

A MULTI-STAGE FERMENTATION SYSTEM FOR FUNDAMENTAL ANAEROBIC DIGESTION RESEARCH,
British Columbia Research Council, Vancouver.
Frank D. Schamburg, and Edwin J. Kirsch.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, March 1966, p 368-380. 4 fig, 2 tab, 13 ref. Public Health Service Grant WP00760-01, Public Health Service Fellowship 5-F1-WP-22, 348-01.

Descriptors: *Anaerobic digestion, *Methane bacteria, *Fermentation, *Alcohols, Escherichia coli, Metabolism, Cultures, Aluminum, Stainless steel, Cellulose, Temperature, Hydrogen ion concentration, Microorganisms, Waste water treatment.
Identifiers: Methanobacillus omelianski, Dead space, Short-circuiting, Interaction, Teflon.

The mechanisms of the anaerobic digestion were studies by culturing the individual organisms which are present in anaerobic digestion. A multi-stage fermenter, the details of which are presented, was used to grow a pure culture of Methanobacillus omelianski. This bacillus was chosen more for convenience than for being representative of the methane formers. Much additional work is needed to build an improved multi-stage fermenter and to grow bacteria which are more representative of the total system and study the interactions between them. (Lowry-Texas)
W71-05173

A FIELD STUDY OF THE EXTENDED AERATION PROCESS,
Cincinnati Univ., Ohio.
James J. Westrick, James M. Morand, and David J. Eye.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, March 1966, p 424-439. 6 fig, 3 tab, 12 ref.

Descriptors: *Design criteria, *Activated sludge, *Ammonia, *Nitrogen, Oxidation, Rotifers, Protozoa, Sedimentation, Organic loading, Chemical oxygen demand, Biochemical oxygen demand, Waste water treatment, *Aeration.
Identifiers: Extended aeration, Detention time, Hydraulic loading, Sludge handling.

Two extended aeration plants were operated and monitored by qualified research personnel. As a result of this experiment, it was discovered that state standards for construction of these installations will result in under designed plants. Also, it was previously thought that these installations required little or no maintenance. This research established the fact that constant and vigilant professional control is essential to the efficient operation of an extended aeration plant. (Lowry-Texas)
W71-05174

AGRICULTURAL AMMONIA FOR STUCK DIGESTERS,
Washington State Univ., Pullman. Div. of Industrial Research.
Fred Cooper, Ervin Hinden, and Gilbert H. Dunstan.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Engineering Bulletin of Purdue University, Vol XLIX, No 4, July 1965, p 126-130. 2 tab, 10 ref.

Descriptors: *Anaerobic digestion, *Ammonia, *Organic acids, *Alkalinity, Methane bacteria, Metabolism, Fermentation, Methane, Temperature, Hydrogen ion concentration, Microorganisms, Waste water treatment.
Identifiers: *Distressed digester, Gas production.

The addition of anhydrous ammonia to stuck digesters to restore favorable microbiological condition has become increasingly popular. While lime may in some cases even favor increased production of volatile acids, anhydrous ammonia does not. Anhydrous ammonia is also more economical in many areas. The conditions leading to digester distress in Pullman, Washington, the remedial action taken with anhydrous ammonia, and the results of this action are presented. Anhydrous ammonia, in this instance, provided virtually complete recovery in 11 days. It must be noted, however, that the appropriate dosage must be carefully calculated and applied in order for this method to be of assistance. (Lowry-Texas)
W71-05175

THE TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES IN AN INDUSTRIAL LABORATORY PLANT,
Farbwerke Hoechst, Frankfurt am Main (West Germany).
Hans Gotte, and Josef Talsky.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, July 1965, p 504-516. 9 fig, 3 tab.

Descriptors: *Radioactivity, *Radioisotopes, Water pollution treatment, Tritium, Decomposition, Waste dilution, Incineration, Chemical precipitation, Slurries, Filters, Plastics, Pesticides, Solvents, *Waste water treatment.
Identifiers: *Radiochemistry, Carbon-14, Iodine-131, Short-life, Long life, Flume hoods, Carcasses, Dyestuffs, Petrochemicals, Pharmaceuticals, Synthetic fibers.

Radiochemical wastes from one of the largest chemical companies in the Federal Republic of Germany are treated in a centralized treatment plant. Contaminated substances include wash water from hygenic showers, equipment washwater, laboratory animal carcasses, and inlet and outlet air filters. Individual treatment processes for each of these waste sources are discussed, with emphasis placed upon the uniqueness of each situation, and the corresponding necessary to evolve a specialized treatment process for each specialized waste. (Lowry-Texas)
W71-05176

DEHYDROGENASE ENZYME AS A PARAMETER OF ACTIVATED SLUDGE ACTIVITIES,
Texas Univ., Austin.
Davis L. Ford, J. T. Yang, and Wesley W. Eckenfelder.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, March 1966, p 534-543. 9 fig, 1 tab, 5 ref.

Descriptors: *Enzymes, *Activated sludge respiration, Incubation, Organic compounds, Temperature, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Dehydrogenase, Sludge age.

Preliminary tests in the laboratory and in the field indicate that dehydrogenase measurement is potentially a valuable analytical tool. According to the literature and laboratory observations by the authors, cellular dehydrogenase activity is directly associated with its growth phase while this activity and respiration rates follow the same kinetics. In biochemical metabolic pathways, organic compounds are broken down through a series of dehydrogenations which can measure the enzymes by using a tetrazolium salt such as TTC as the hydrogen acceptor. (Ellis-Texas)
W71-05177

CENTRIFUGAL DEWATERING OF PRIMARY PAPER INDUSTRY SLUDGES,
National Council for Stream Improvement, Corvallis, Oreg.
R. O. Blosser, and A. L. Caron.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Engineering Bulletin of Purdue University, Vol L, No 2, March 1966, p 450-456. 9 fig, 1 tab, 2 ref.

Descriptors: *Dewatering, Pilot plant, Retention, *Sludge, Costs, Pulp and paper industry, *Pulp wastes, Coagulation, *Waste water treatment.
Identifiers: *Centrifugal, Vacuum treatment.

Extensive pilot plant work and field installations have revealed some of the factors which affect the efficiency of sludge dewatering such as: (1) bowl speed, (2) detention time in the bowl; and (3) feed sludge consistency. The advantages of the equipment described are: (1) it required little supervision; (2) it is capable of handling wide variations in fed sludge consistency; (3) has a low space requirement; (4) it eliminates the need for chemical conditioning; and (5) the costs are competitive with vacuum filtration. Limitations observed were that trash in the form of chips and sticks cannot be handled and flow rates must be held at a low level on gpm to horsepower ratio to obtain satisfactory solids recovery. (Ellis-Texas)
W71-05178

REGIONAL WASTE WATER MANAGEMENT SYSTEMS,
Massachusetts Univ., Amherst.
R. J. Giglio, D. D. Adrian, F. C. Kaminsky, and R. F. Rikkers.
In: The Proceedings of the Jerusalem International Conference on Water Quality and Pollution Research, p 229-239, June 1969.

Descriptors: *Water quality standards, Decision-making, Mathematical model, Interceptors, Optimization, Stochastic process, Biochemical oxygen demand, Non-linear programming, Economies of scale.
Identifiers: *Waste water treatment systems, Regional planning, Stream vector, System network, Cost function, Cost effectiveness.

The research described is directed toward the development of a methodology and mathematical model to aid planning agencies in regional waste water management. The waste water management system is viewed as a set of subsystems models with unique characteristics. The most basic subsystem is the sewage source or flow with an associated stream vector. The treatment plants of the primary, secondary and tertiary variety are the second subsystem. Other subsystems to be considered are the system network or interceptors connecting treatment plants and sewage sources and the river effluent. The major emphasis is on the manner in which elements of the stream vector change from an input of a subsystem to an output of that system. The author uses economic data on construction and operating costs for waste treatment facilities assuming economies of scale. Results of the work on subsystems determine which plans are feasible subject to cost constraints. A region in Massachusetts has been selected for a pilot study of this model. (Siegenthaler-Rutgers)
W71-05227

TREATMENT OF EFFLUENTS BY ELECTROLYTIC METHODS IN BRITAIN,
M. R. Hillis.
Water and Pollution Control, Vol 108, No 12, p 22-27, December 1970. 6 fig, 9 ref.

Descriptors: *Electrolysis, *Ion transport, *Oxidation-reduction potential, Anodes, Cathodes, Phenols, Copper, Flotation, Toxicity, Electrochemistry, Industrial wastes, Sewage treatment, Waste water treatment, Effluents.
Identifiers: *Great Britain, Pickle liquor, Photographic wastes, Plating wastes.

Electrolysis for treatment of industrial effluents was practiced before 1900 but was abandoned because the technology was not advanced far enough. At the present time, electrolytic treatment is proving extremely beneficial, mainly due to increased technology and experience in the area, to

ndustrial applications involving ions or ion com-lexes which are toxic to conventional treatment ystem bacteria. Examples of both recovery and euse of valuable materials, and complete destruc-on of unrecoverable materials are presented. (El-s-Texas)
/71-05261

ATE OF PHOSPHORUS IN WASTE TREAT-IENT PROCESSES: ENHANCED REMOVAL F PHOSPHATE BY ACTIVATED SLUDGE,
alifornia Univ., Richmond. Sanitary Engineering esearch Lab.
rnold B. Menar, and David Jenkins.
nvironmental Science and Technology, Vol 4, No 2, p 1115-1121, December 1970. 6 tab, 6 fig, 12 f.

escriptors: *Phosphates, *Precipitation, *Carbon oxide, *Hydrogen ion concentration, Dissolved xygen, Chemical oxygen demand, Organic load-g, Activated sludge, Pilot plant, Waste water eatment, Texas.
entifiers: *Biological luxury uptake, *Calcium ecipitation, *Calcium phosphate entrapment, arbon dioxide stripping, Phosphorus assimilation, gglomeration, Sludge volatility, Suspended solids, lling Road Plant, San Antonio (Tex).

ctivated sludge must contain 2-3% phosphorus by eight in order to grow. Phosphorus removals in cess of this level are caused by chemical ecipitation with the phosphate being entrapped the sludge floc and carried along with it. ecipitation is dependent on sewage pH, which is turn dependent upon CO2 concentration. If at me point along the length of the aeration basin e DO and pH rise, then precipitation will occur th a resulting phosphorus removal. This enomena is not dependent upon the conven-nal operational parameters such as organic load-g and mixed liquor suspended solids. (Lowry-xas)
71-05262

REATMENT OF SHIPBOARD WASTES,
ew Mexico State Univ., University Park. Dept. of vil Engineering.
hn W. Hernandez, Edward T. Kinney, and rold H. Singerman.
oceedings, Industrial Waste Conference, 21st, ay 3, 4, 5, 1966, Purdue University, Vol L, No 2, 80-891, March 1966. 3 fig, 3 tab, 7 ref.

escriptors: Water pollution sources, *Design ndards, *Coliform, *Chlorination, Disinfectant, ak discharge, Electrochemistry, Biological treat-nt, Biochemical oxygen demand, *Waste water atment.
entifiers: Warships, Small craft, *Shipboard vage, Flush water, Maceration, Suspended ids, Thermal solids destruction, Electrochemical ids destruction.

val vessels of the United States Navy, commer-l vessels, and private pleasure crafts can no ger be ignored as pollution sources in coastal ters. An interagency committee within the deral government has proposed shipboard treat-nt requirements. Between 10 and 20 gpd of ste per man are produced on ships following a rmal work load, as reported by a shipboard waste vey. The maximum flow can be from 200 to 0% of the average flow. Shipboard evaluations of nacerator-chlorinator established the feasibility using a single unit for multiple fixtures. Data in-ates that a substantially coliform-free effluent be expected, if available chlorine is maintained ve 1300 mg/l/flush. (Lowry-Texas)
71-05263

OTATION OF OILY WASTES,
bil Oil Co., Trenton, Mich.
lph E. Quigley, and E. L. Hoffman.
oceedings, Industrial Waste Conference, 21st, y 3, 4, 5, 1966, Engineering Bulletin of Purdue University, Vol L, No 2, p 527-533, March 1966. 3 fig, 4 ref.

Descriptors: *Flotation, *Oil wastes, *Flocculation, Separation techniques, Sedimentation, *Waste water treatment, Lime, Costs.
Identifiers: API separator, Alum.

A general discussion of the theory of primary separation, air flotation, and flocculation of oily wastes is conducted. The waste water system in use at the Trenton Refinery is described along with the results of operation. Flocculation increases the efficiency of the flotation process and alum or lime have given significant improvements in the oil-water separation process. The operating costs of the waste water system have varied but a typical cost would be about 11.5 cents per 1000 gallons. (Ellis-Texas)
W71-05265

PRECIPITATION OF HIGH DENSITY METALLIC HYDROXIDES FOR RECOVERY OR DISPOSAL,
Infilco, Tucson, Ariz.
R. R. Evans.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 511-515, March 1966. 2 fig, 2 tab.

Descriptors: *Chemical precipitation, Metals, *Sludge, *Dewatering, *Waste water treatment.
Identifiers: *Metal hydroxides, DENSATOR, Clarifier.

In an effort to produce a dense, easily dewatered metal hydroxide sludge, INFILCO has developed a proprietary process by the techniques which they have used successfully to produce high density calcium carbonate and magnesium hydroxide sludge in water treatment. INFILCO believes the DENSATOR clarifier incorporates the following principles to an unprecedented degree: (1) it insures completion of the precipitation reaction; (2) it is easily controlled; (3) it produces minimum sludge volume; and (4) it produces a less hydrous sludge which is easily dewatered. (Ellis-Texas)
W71-05266

APPLICATION OF INDUSTRIAL PHOTOSYNTHESIS PROCESS TO WASTE WATER RENOVATION SYSTEMS,
North American Aviation, Inc., El Segundo, Calif. S and ID Life Sciences.
R. H. T. Mattoni, H. Nugent Myrick, and E. C. Keller, Jr.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Engineering Bulletin of Purdue University, Vol XLIX, No 4, p 684-705. 17 fig, 1 tab.

Descriptors: *Algae, *Biomass, Water purification, *Protozoa, *Fungi, *Bacteria, Hydrogen ion concentration, Temperature, Alkalinity, Bicarbonates, Bactericide, Kinetics, Hardness, Coliforms, Cytological studies, Evaporation, Microorganisms, California, *Photosynthesis, Waste water treatment.
Identifiers: Industrial photosynthesis, Mean doubling time, Packed cell volumes, Bacterial plate counts, Lancaster (Calif).

Industrial photosynthesis refers to the controlled growth of complex populations of microorganisms, mainly unicellular algae, on complex organic substrates such as primary and secondary waste waters. The goal of this process is to produce salable biomass in addition to increasing the water quality to levels acceptable for irrigational or recreational uses. Three full-scale tank reactors were used to perform experiments on selection processes, pH dependence, and temperature dependence. The natural selection of a simple array of species from a complex seed was demonstrated. pH, however, was shown to have little effect on the relative species frequency profiles. It was also determined that when reactors are operated in an identical fashion, they do produce identical populations of microorganisms. The experiment was situated in an area known for high temperature and cloud free days. During the experiment, however, the region was experiencing its annual temperature minimums, with ice forming on the tops of the reactors. In spite of this, growth rates obtained were comparable to growth rates during the spring, summer, and autumn, demonstrating these systems to be applicable even where freezing temperatures are encountered during part of the diurnal cycle. Finally, the final reductions of bacteria were shown to be a function of algae growth. This was attributed to bacteriocidal enzymes excreted by the algae. (Lowry-Texas)
W71-05267

TRACE METALS AND FILAMENTOUS MICROORGANISM GROWTH,
Kansas Univ., Lawrence. Environmental Health Engineering Lab.
John T. Pfeffer, Aziz A. Samra, and Diann T. Schwegler.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 608-617, July 1965. 5 fig, 5 tab, 15 ref.

Descriptors: *Trace elements, *Microorganisms, Molds, Bacteria, Sludge water analysis, Water chemistry, Water properties, *Waste water treatment.
Identifiers: Filamentous fungi, Sludge bulking.

An investigation of the chemical environment as related to solubility and to the growth characteristics of filamentous microorganisms as related to the presence of trace metals was conducted. As a result of these experiments and literature search it was found that the trace metal requirements for filamentous fungi are different from bacteria and when the trace metal required for bacterial growth is missing, fungi can predominate with sludge bulking occurring. Good fungal growth was obtained in glucose with only iron or zinc present while the presence of copper tended to retard fungal growth. The chemical environment is quite important in controlling the availability of trace metals. (Ellis-Texas)
W71-05268

A FIELD COUNTERCURRENT EXTRACTOR FOR WATER POLLUTANTS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
Robert L. Bunch, and M. B. Ettinger.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 93-97, July 1965. 2 fig, 1 tab, 1 ref.

Descriptors: Water pollution, *Separation techniques, *Solvent extractions, Pumps, Pressure, Organic matter, Chemical oxygen demand, *Waste water treatment.
Identifiers: Countercurrent extractor, Contactor.

A complete portable liquid extractor has been fabricated for recovering organic pollutants from surface waters. A precise description of these organic pollutants is necessary if we are to deal effectively with today's complex pollutional problems. Most organic pollutants occur in minute concentrations and some means of concentrating these materials is necessary before analysis and identification can be made. Direct solvent extraction would add substantially to the present capability for isolating contaminants from surface water. Podbielniak, Inc. of Franklin Park, Illinois, has fabricated an extractor with necessary pumps, flow meters, pressure gauges, and other accessory equipment mounted on a 6 ft x 10 ft skid which will be mounted on a 14 ft stake bed truck and a separate truck will carry the generator and the solvent to give a completely portable, self-contained unit that can be operated at almost any location. This unit should find use in extracting carcinogenic polynuclear hydrocarbons and pesticides, and in capturing 'slug' doses of organic pollutants in river water. (Ellis-Texas)

W71-05269

PLASTIC TRICKLING FILTER--ACTIVATED SLUDGE TREATMENT OF PAPER WASTES,
Tufts Univ., Medford, Mass. Northeast Research Center.
R. H. Follett.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, and 6, 1965, Purdue University, Vol XLIX, No 4, p 120-125, July 1965. 4 fig.

Descriptors: *Trickling filters, *Activated sludge, *Pulp wastes, *Pulp and paper industry, *Filters, *Organic loading, *Waste water treatment, Solids contact process, Biochemical oxygen demand.
Identifiers: Plastic trickling filter, Loading, Hydraulic load.

A pilot plant implementing the subject process was operated over a two-year period, treating settled effluent from a fine papermill, boardmill, and a papermill employing deinking, the effluent from the latter contained the discharge from both the pulp and the papermills. The pilot plant consisted essentially of those units that are inherent to the activated sludge and trickling filter processes. The combination system provides improved performance, reduced costs and improved settleability. The trickling filter could be used as a cooling tower to cool hot waste to a degree that is amenable to treatment by the activated sludge unit. Operating costs would probably be somewhat lower since the reduction in the aeration power requirement may be greater than the power differential for raising the return sludge to a greater head. The greatest advantage of the combined system appears to be the uniformity of performance at high loading rates. (Ellis-Texas)
W71-05270

LOW PRESSURE WET AIR OXIDATION OF SEWAGE SLUDGE,
Sterling Drug, Inc., Rothschild, Wis. Zimpro Div.
G. H. Telezke.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Purdue University, Vol XLIX, No 4, p 40-48, July 1965. 7 fig, 4 tab, 1 ref.

Descriptors: *Pressure, *Temperature, *Oxidation, *Sewage sludge, Filtration, Sands, Filters, Chemical oxygen demand, *Waste water treatment.
Identifiers: Nonputrescible, Sterile, Residue, Specific resistance value.

Low-pressure wet air oxidation provides an economical and flexible method of producing a sterile, readily drainable, and completely acceptable end product for ultimate disposal. The objective of the Zimpro sludge treatment is to produce such a product which is easily concentrated to the minimum volume consistent with the lowest overall treatment and disposal cost. High temperatures (300-400F) and variable pressure (150-3000 psi) are used in this process. Low specific resistance values are indicative of a sludge with rapid characteristics and Swanwick, et al, have made many measurements and determined that the specific resistance value must be reduced to at least 40 x 10 to the 7th power sec sq/g for various sludges. The sludges under wet air oxidation showed x values mostly around 10 x 10 to the 7th power sec sq/g. The low pressure unit should prove to be applicable for the great majority of installations in the U. S. (Ellis-Texas)
W71-05271

ION FLOTATION FOR INDUSTRIAL WASTES: SEPARATION OF HEXAVALENT CHROMIUM,
Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
R. B. Grieves, T. E. Wilson, and S. CM. Schwartz.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Purdue University, Vol XLIX, No 4, p 110-119, July 1965. 6 fig, 2 tab, 10 ref.

Descriptors: *Chromium, *Foam separation, *Surfactants, Foam fractionation, Separation techniques, Foaming, Tertiary treatment, *Waste water treatment, Industrial wastes, Ions.
Identifiers: EHDA, Bromine, *Chromates, *Dichromates, Concentration, Batch feed, Continuous feed, *Ion flotation.

The objective of this investigation is the establishment of the feasibility of ion flotation (foam separation) for the separation of hexavalent chromium from aqueous solution, using a cationic surfactant which would form an insoluble complex with the dichromate ion. With batch operations, lower residuals of dichromate and of surfactant were obtained than with continuous operation. For continuous operation at a detention time of approximately 150 minutes, a 50 milligram per liter feed stream of dichromate could be split via ion flotation into a foam stream containing 450 milligrams per liter of dichromate and a residual stream containing 15 milligrams per liter of dichromate. The flow rate of the residual stream would be 92% of the feed stream. Greater reductions in the residual dichromate could be achieved by multicolumn operation and by variations in operating variables. (Ellis-Texas)
W71-05272

AUTOXIDATION OF WOOD DISTILLATION WASTES WITH OXYGEN,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
Boyd T. Riley, Jr., John E. Kiker, Jr., and Charles I. Harding.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 926-942, March 1966. 9 fig, 1 tab, 7 ref.

Descriptors: *Acidic water, *Toxicity, Kinetics, Chemical oxygen demand, Phenols, Biological treatment, Chemical degradation, Chromatography, Industrial wastes, Waste water treatment, *Oxidation, *Pulp wastes.
Identifiers: *Autoxidation, Chain reactions, Parr reactor, Antioxidants, Destructive distillation, Charcoal, Retort.

Wood distillation wastes have resisted both biological and chemical treatment. Such wastes have COD's of approximately 100,000 mg/l, a pH of 2-3, and an extremely dark color. While biological treatment is possible, it is not economically feasible, nor is iron coagulation, lime neutralization coagulation following chlorination, extraction, or direct application to unpaved roads. Because air and oxygen are relatively abundant and inexpensive compared to the chemicals needed for some of the other methods, autoxidation was selected as a likely treatment method. Experiments showed temperature to be the most important factor in establishing the rate and completeness of an autoxidation reaction. The first test performed was only of limited success yielding a dilution figure of 1:90 as opposed to 1:100 for the raw waste. The temperature and the pressure were then increased to 260C and 100 psi respectively. The volume of reactor for the first test was 67 liters, and for the second test it was 1.86 liters. This smaller volume had a much higher mixing level, which partially accounted for a conversion rate of 230 mg/l min in the small reactor as opposed to 20 to 30 mg/l min in the larger reactor. As much as 80% treatment of the waste was observed in a period of 10 minutes, while tripling the reaction time increased the percentage to only 87%. The attinability of removals of this range showed that autoxidation of wood wastes does offer considerable promise of being an excellent treatment method for wood distillation wastes. (Lowry-Texas)
W71-05273

THE CONTROL OF ACID MINE DRAINAGE POLLUTION BY BIOCHEMICAL OXIDATION AND LIMESTONE NEUTRALIZATION TREATMENT,
National Coal Board, Yorkshire (England).
H. G. Glover.
Proceedings, Industrial Waste Conference, 22r
May 2, 3, 4, 1966. Purdue University, Vol L II,
2, July 1968. 11 fig, 3 tab, 59 ref.

Descriptors: *Mine wastes, *Acid mine wat
*Oxidation, *Waste water treatment, Limeston
Neutralization, Sedimentation, Filtration, Cos
Mine drainage, Water pollution control.
Identifiers: *Biochemical oxidation.

A new process for the purification of acid draina
from coal mining operations is described. No
features include the biochemical oxidation of fe
rous salts in acid solution and the application
mechanical attrition to limestone grit which is us
for the chemical neutralization of the oxidiz
drainage. The new process will be most applicat
to the more dilute acid drainages for which the co
ventional lime process is less suitable, and costs
the new process are expected to be appreciably l
than the costs of the lime process. (Ellis-Texas)
W71-05274

PERCOLATION OF CITRUS WASTE THROUGH THE SOIL,
Engineering--Science Inc., Arcadia, Calif.
Donald R. Anderson, William D. Bishop, and Harvey F. Ludwig.
Proceedings, Industrial Waste Conference, 21
May 3, 4, 5, 1966. Purdue University, Vol L, No
p 892-901, March 1966. 3 fig, 4 tab, 5 ref.

Descriptors: *Lemons, Industrial wastes, Irrigatio
Furrows, *Percolation, Organic wastes, Organ
loading, Alkalinity, Conductivity, Aerobic trea
ment, Chemical oxygen demand, Waste wat
treatment, California, Waste disposal.
Identifiers: *Lemon Products Division, *Citr
wastes, Suspended solids, Corona (Calif).

Lemon Products Division, of Corona, Californi
handles an average of 435 tons of lemons per wor
ing day. Their processing operations discharge a
average daily liquid waste flow of 820,000 gallon
including unused portions of the fruit, and proce
chemicals used for pH adjustment. The previo
method of waste disposal was ponding the wastes
a series of lagoons. This method, generally u
satisfactory because of odor problems, was disco
tinued in favor of land irrigation. This dispos
covers a total of 200 acres, with approximate
one-third of this area being used each four mon
period, and then left fallow or planted to crops. I
using furrows, the effluent may be spread even
over the surface, and the ridges between furrow
which remain exposed to the air, act as air supp
ducts to keep the system from going anaerobi
During the operation, the furrows are filled to
depth of approximately six inches, and then a
lowed to dry. This process is repeated 3 times b
fore the field must be disced and then refurrowe
With a normal average flow of 820,000 ga
lons/day, and an area of 66 2/3 acres, the depth
water over the surface will be 46 inches, 50%
which evaporates, and 50% of which percolate
Suspended solids are removed almost immediatel
and as they build up they clog the soil pores and th
liquid moves on down the furrow. After drying an
discing these solids become part of the soil. Th
mean COD loading rate, 13.0124 lb/ft sq/day, is ap
proximately 10 times the loading rate of conve
tional intermittent sandfilters. (Lowry-Texas)
W71-05275

COMPARISON OF ANAEROBIC-AEROBI AND AEROBIC LAGOON TREATMENT,
Missouri Univ., Columbia.
D. L. King, and D. R. Bunn.
Proceedings, Industrial Waste Conference, 21s
May 3, 4, 5, 1966. Purdue University, Vol L, No
p 248-257, March 1966. 5 tab, 12 ref. Water Pollu
tion Control Administration Training Grant 1T
WP-30-01A1.

Descriptors: *Aerobic treatment, Aerobic condi
tions, Anaerobic conditions, Aerobic bacteria, Dis
solved oxygen, Carbon cycle, *Biochemical oxyge

demand, Chemical oxygen demand, Energy, *Waste water treatment, *Oxidation lagoons.
Identifiers: *Caloric energy.

Laboratory studies were made in an attempt to describe the degree and type of treatment afforded by an anaerobic-aerobic lagoon system and compare it with the treatment provided by the more widely used aerobic facilities. Parameters investigated include BOD, COD, total caloric energy, and organic solids. The results of testing these parameters indicated that the aerobic cell gave better and more complete treatment than the anaerobic-aerobic series. It was shown during this investigation that BOD is not the best indicator of the amount of organic degradation accomplished within such systems and that another parameter is needed to support BOD data. (Ellis-Texas)
W71-05276

ULTIMATE DISPOSAL OF CONCENTRATED WASTES BY INCINERATION,
Chrysler Corp., Detroit, Mich.
For primary bibliographic entry see Field 05E.
W71-05277

SOME OBSERVATIONS ON LIQUID-SOLIDS SEPARATIONS WITH PARTICLE GROWTH,
Mellon Inst., Pittsburgh, Pa.
J. C. Bramer, and R. D. Hoak.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Purdue University, Vol XLIX, No 4, p 423-434. 9 fig, 3 tab, 4 ref.

Descriptors: *Liquids, Sedimentation, *Sedimentation rates, Coagulation, *Suspension, Flocculation, Separation techniques, Settling, Waste water treatment.
Identifiers: Solids, *Particle growth, Sedimentation index, Electrokinetic properties, Kaolin, Mobility.

The results of experiments conducted to investigate the mechanism of sedimentation with suspensions of a self-coagulating clay are described. The concept of the 'sedimentation index' and an instrumental measure of the electrokinetic properties of suspension were utilized. (Ellis-Texas)
W71-05278

RESEARCH AND DEMONSTRATION PROJECTS IN THE ABATEMENT OF ACID MINE DRAINAGE,
Pennsylvania Dept. of Health, Harrisburg.
For primary bibliographic entry see Field 05G.
W71-05279

EVALUATING THE EFFECT OF INDUSTRIAL WASTES ON LAGOON BIOTA,
Missouri Univ., Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-05280

USE OF OXYGEN IN SLUDGE STABILIZATION,
Union Carbide Corp., Tonawanda, N. Y.
H. Bruemmer.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 544-558, March 1966. 6 fig, 7 tab, 18 ref.

Descriptors: *Oxygen, *Sludge, *Sludge treatment, Sludge disposal, Nitrogen, Phosphorous, Aerobic conditions, Biota, Chemical oxygen demand, Biochemical oxygen demand, *Waste water treatment, Aeration.
Identifiers: *Stabilization, Total solids, Volatile solids.

Studies were conducted in the laboratory using batch and draw-fill types of treatment systems to compare the use of oxygen with air in the aerobic stabilization of sludge. As a result of these experiments it was found that the use of oxygen is about 10 times more efficient than air per volume of gas sparged when high loadings are distributed over the day in 10 equal portions. Filtrates from aerobic stabilized sludge contain about two mg/l phosphate and about 8 mg/l total nitrogen. The rate that primary sludge can be suitably stabilized under optimal conditions of oxygenation is determined by the biological limitations of the biota. The minimal time for processing raw sludge containing 50,000 mg/l COD in the system described is about four days at 30C. (Ellis-Texas)
W71-05281

PULP MILL WASTE DISPOSAL AT SPECIFIC INSTALLATIONS IN SWEDEN,
Swedish Water and Air Pollution Research Lab., Stockholm.
Stig Freyschuss.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 791-798, March 1966. 5 tab.

Descriptors: *Pulp and Paper industry, *Waste dilution, *Aquatic environment, *Toxicity, Wood wastes, Fibers (Plant), Slurries, Sedimentation, Hydrogen ion concentration, Chemical oxygen demand, Biochemical oxygen demand, Oxidation, Alkalinity, Acidity, *Pulp wastes, Waste water treatment.
Identifiers: *Nymolla Sulphite Mill, *Morrum Sulphate Mill, Bleach, Sweden.

Two pulp mills, located in Sweden, were investigated with regard to the amount of pollution they were producing. Both mills were located in the center of a thriving tourist trade, and both mills discharged their effluents into waters known for sport and commercial fishing. Waste output was analyzed in terms of Kg/ton of pulp as COD, BOD, fiber, and magnesium. Comparisons of these parameters were made for soft wood versus hard wood, with the hard wood generally having the higher values. Data were also collected on the same parameters at the sea disposal outlets from the two plants, and no detectable increase was observed. The overall effects of the effluent from the plant seem to be negligible, and not in any way harming either aquatic or plant life in the area. (Lowry-Texas)
W71-05282

AERATED STABILIZATION OF BOARD MILL WHITE PAPER,
Crown Zellerbach Corp., Camas, Wash.
Herman R. Amberg.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 525-537, March 1966. 4 fig, 9 tab, 6 ref.

Descriptors: *Aeration, Pulp and paper industry, Oxidation lagoons, Biochemical oxygen demand, Biological treatment, Sludge, Industrial wastes, *Pulp wastes, *Waste water treatment, Stabilization.
Identifiers: *Aerated stabilization, Suspended solids.

A survey of the results and comparison of the present operational efficiency of the aerated stabilization lagoon with the efficiency of the original stabilization pond is presented. It was found that by adding aerators to the stabilization ponds an average of 81% of the BOD was removed, a suspended solids reduction of approximately 91%, and a biological sludge production of about 4.5 lbs/lb of BOD removed. The aeration basin, operated as a completely mixed system, was extremely effective in handling wide fluctuations in daily BOD load. Operating costs for the Baltimore treatment plant have been calculated at $0.72/ton of production or $0.0162/lb of BOD removal. (Ellis-Texas)
W71-05283

TOXICITY OF COPPER TO ACTIVATED SLUDGE,
Mead Corp., Chillicothe, Ohio.
K. C. Ayers, K. S. Shumate, and G. P. Hanna.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 516-524, March 1966. 5 fig, 1 tab, 7 ref.

Descriptors: *Activated sludge, *Copper, *Toxicity, Sewage treatment, Industrial wastes, Biochemical oxygen demand, Chemical oxygen demand, Respiration, Sludge, Waste water treatment, Water pollution effects.
Identifiers: Shock loading.

Studies were carried out at The Ohio State University in which attempts were made to investigate the actual mechanism causing partial failure of the activated sludge process due to shock loadings of copper. The following hypotheses were formulated as a result of these investigations: (1) when copper bearing sewage enters the aeration tank there is a rapid redistribution of copper between the available ligands; (2) the copper equilibrium and the toxic effect will depend on copper dosage, MLSS, and influent sewage strength; (3) metabolically inactive copper complexes may be reversed, either by dilution or by the addition of uncomplexed ligands; and (4) the appearance of bacterial cells in the effluent is a result of the toxic effect of sludge. (Ellis-Texas)
W71-05284

TEMPERATURE AND RETENTION TIME RELATIONSHIPS IN THE ACTIVATED SLUDGE PROCESS,
Rutgers - The State Univ., New Brunswick, N.J.
Joseph V. Hunter, Emil J. Genetelli, and M. E. Gilwood.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 953-963, March 1966. 5 fig, 8 tab, 8 ref.

Descriptors: *Temperature, Protozoa, Rotifers, Nitrogen, Evaporation, Biochemical oxygen demand, *Activated sludge, Waste water treatment, *Sludge treatment.
Identifiers: *Retention time, *Synthetic wastes, SVI-Sludge volume index, DNA-Desoxy ribonucleic acid, Filamentous microorganisms, Bulking sludge, Suspended solids.

As effluent standards become more strict, treatment methods previously rejected for economic reasons become more attractive. Temperature and retention time have been, investigated as possibly coming within the economical range in the near future. Increasing temperatures between 4C and 45C effected little change in BOD or SS removal efficiencies, but did result in decreased sludge carbohydrate and volatile matter contents, and increased sludge nitrogen content. Increased temperature also caused increased rotifer and protozoan population, while decreasing filamentous organisms and resulting in less MLSS accumulation. There was no uniform trend either for DNA content or SVI with temperature. Increased retention time caused decreased MLSS accumulation and higher BOD and SS removal efficiencies, while sludge volume index was not directly affected. From this study sludge, DNA content was shown to be better indicator of sludge bulking than the general appearance of the sludge under microscopic examination. (Lowry-Texas)
W71-05285

PURE CULTURE STUDIES OF METHANOGENIC BACTERIA,
Florida Univ., Gainesville.
P. H. Smith.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Purdue University, Vol XLIX, No 4, p 583-588, July 1965. 2 fig, 2 tab, 8 ref.

Descriptors: *Cultures, *Bacteria, *Methane bacteria, Oxidation, Oxygen, Microbiology, Sludge treatment, Anaerobic conditions, Aerobic conditions, Hydrogen, Sludge, Waste water treatment.
Identifiers: *Methanogenic organisms, Substrate utilization.

The methods described were developed from the basic procedures of R. E. Hungate and have been successfully applied in the isolation and study of methanogenic bacteria from domestic sewage sludge. Pure culture studies of methanogenic organisms are difficult, owing to the extreme sensitivity of the organisms to molecular oxygen. These organisms can be isolated in pure culture using techniques which adequately control the oxygen tension. Methods for the isolation of hydrogen oxidizing methanogenic bacteria have been described. (Ellis-Texas)
W71-05286

PROJECT SALT VAULT: RADIOACTIVE WASTE DISPOSAL IN A SALT MINE,
Oak Ridge National Lab., Tenn.
W. J. Boegly, R. L. Bradshaw, F. M. Empson, W. C. McClain, and F. L. Parker.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965. Purdue University, Vol XLIX, No 4, p 398-409, July 1965. 8 fig, 6 ref.

Descriptors: *Radioactive waste disposal, Temperature, Heat transfer, Economics, Radioactive wastes, Thermal radiation, Heat, Infrared radiation, Effluent, Pressure, *Waste disposal, Waste water treatment.
Identifiers: Project Salt Vault, Salt mine, The Carey Salt Company.

Chemical reprocessing of power reactor fuel produces a chemically complex and hazardous effluent that cannot be handled by conventional waste disposal methods. Studies on the disposal of high-level liquid and solid wastes were initiated at Oak Ridge National Laboratory (ORNL) to consider the heat transfer from the waste to the salt, the effects of heat and radiation on rock salt, and the economics of an actual disposal facility in a salt mine. The inactive salt mine of the Carey Salt Company of Lyons, Kansas, was chosen as a demonstration site to test and evaluate the engineering and scientific objectives. The waste-handling experience and the salt-flow data obtained in this experiment, when combined with the results of laboratory and theoretical studies on the structural stability of rock salt at elevated temperatures and pressures, should allow the establishment of a basis for the design of an actual disposal facility for optimum use of salt-mine waste. (Ellis-Texas)
W71-05287

5E. Ultimate Disposal of Wastes

PETROCHEMICAL WASTE DISPOSAL,
Department of Health, Edmonton (Alberta).
E. E. Kupchanko.
Man and His Environment, Vol 1, Proceedings of the First Banff Joint Conference on Pollution, The University of Calgary and the Engineering Institute of Canada, May 16-17, 1968, Banff, Alberta, Canada: New York, NY, Pergamon Press, Inc, p 53-65, 1970. 13 p, 8 fig, 42 ref.

Descriptors: *Water pollution sources, *Oil industry, *Oil wastes, *Waste treatment, *Canada, Deep well disposal, Methodology, Oily water, Water quality, Organic matter, Chemical analysis, Biochemical oxygen demand, Activated sludge, Adsorption, Oxidation, Chemicals.

Water pollution from petroleum industries and methods of waste disposal are presented. A nationwide survey in Canada indicated that the net pollution load from petroleum refineries measured as Biochemical Oxygen Demand yielded an approximate industry average of 100 lbs. per 1000 barrels of crude processed. The complexities of the disposal of Petrochemical waste calls for considerable study and evaluation of problems peculiar to each operation. Water reuse is becoming increasingly important because of the added costs of waste treatment. Disposal of mercaptans, hydrogen sulfide, oil, caustic and organic wastes is often troublesome in the petroleum and petrochemical industry and several methods are available for their removal from waste waters. Deep well disposal appears to offer a practical and economical method of disposing of extremely objectionable waste materials. Preliminary evaluation of other methods of treatment such as adsorption and solvent extraction appear, in certain circumstances, to be feasible. (See also W71-04901) (Woodard-USGS)
W71-04903

EGG LAYING HOUSE WASTES,
Steeg (Henry B.) and Associates, Inc., Indianapolis, Ind.
For primary bibliographic entry see Field 05D.
W71-05009

TREATMENT AND DISPOSAL OF EFFLUENT FROM A 450 TON PER DAY KRAFT PULP AND PAPER MILL INTO CLASSIFIED INLAND WATERS,
New Zealand Forest Products Ltd., Tokoroa.
For primary bibliographic entry see Field 05D.
W71-05011

DISPOSAL OF EFFLUENTS FROM PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS,
Bayerische Biologische Verouchsaustalt, Munich (West Germany).
For primary bibliographic entry see Field 05D.
W71-05015

HYDROLOGIC IMPLICATIONS OF SOLID-WASTE DISPOSAL,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-05094

DISPOSAL OF TITANIUM DIOXIDE WASTE IN A STRATIFIED ESTUARY,
Norsk Institutt for Vannforskning, Blindern.
For primary bibliographic entry see Field 05D.
W71-05159

WATER QUALITY, THE STATE OF THE ART,
Wayne State Univ., Detroit, Mich.
For primary bibliographic entry see Field 05G.
W71-05212

PERCOLATION OF CITRUS WASTES THROUGH THE SOIL,
Engineering--Science Inc., Arcadia, Calif.
For primary bibliographic entry see Field 05D.
W71-05275

ULTIMATE DISPOSAL OF CONCENTRATED WASTES BY INCINERATION,
Chrysler Corp., Detroit, Mich.
A. R. Balden.
Proceedings, Industrial Waste Conference, 21st, May 3, 4, 5, 1966. Purdue University, Vol L, No 2, p 581-590, March 1966. 8 fig, 2 ref.

Descriptors: *Ultimate disposal, *Incineration, Solid wastes, Sludge disposal, *Waste disposal, Waste water treatment.
Identifiers: *Fluidized beds, Polymerization.

Brief descriptions were presented of: (1) the procedures by which the pollutants are removed from the liquid plant wastes; (2) a few of the experiments that have been conducted to achieve ultimate disposal of these concentrated waste materials; (3) an installation by which disposal of an oily waste is currently being achieved. Incineration techniques to include fluidized bed, pit, and polymerization are discussed. (Ellis-Texas)
W71-05277

PULP MILL WASTE DISPOSAL AT SPECI INSTALLATIONS IN SWEDEN,
Swedish Water and Air Pollution Research L Stockholm.
For primary bibliographic entry see Field 05D.
W71-05282

PROJECT SALT VAULT: RADIOACTI WASTE DISPOSAL IN A SALT MINE,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05D.
W71-05287

5F. Water Treatment and Quality Alteration

BOVINE SALMONELLOSIS (S. TYHIMURIU IN A FEEDLOT OPERATION,
W. C. Oglesby.
Veterinary Medicine/Small Animal Clinician, V 59, p 172-174, February 1964. 4 ref.

Descriptors: *Salmonella, *Cattle, Antibioti Temperature, Animal diseases, Stagnant wat Mud, Waste treatment, Diseases, Public heal Water pollution effects.
Identifiers: *Feedlot, Diarrhea, Salmonella phimurium, Necropsy, Medication, Nitrofurazon

An epizootic of a severe respiratory-enteric sy drome appeared in a feedlot operation of 1,0 head of cattle. Salmonella typhimurium was i lated from the organs of 5 carcasses, 3 fe specimens, and from mud in a waterhole fr which the animals drank. Correction of hygie conditions, electrolyte supplementatio sulfathiazole medication in the drinking water, a intravenous antibiotics gave only mediod response. Individual dosing with a nitrofurazo preparation and addition of nitrofurazone to drin ing water was successful in eradicating the disea (White-Iowa State)
W71-04918

BOVINE SALMONELLOSIS ASSOCIATE WITH CONTAMINATED CREEK WATER AN HUMAN INFECTION,
Kansas State Univ., Manhatton. Coll. of Veterina Medicine.
C. M. Hibbs, and V. D. Foltz.
Veterinary Medicine/Small Animal Clinician, V 59, p 1153-1155, November 1964. 6 ref.

Descriptors: *Sewage, *Salmonella, Cattle, Sewag bacteria, Water pollution effects, Streams, Infe tion, Public health, Diseases, Waste treatment.
Identifiers: Human infection, Nicropsy, Diarrhe Salmonella typhimurium, Bacteriologic examin tion, Water samples.

A case of Salmonellosis in calves, which may hav been associated with human infection, is discusse Salmonella typhimurium was isolated from tw calves, creek water and one human. Though th origin of the infection was not specifically dete mined, the findings indicated that untreated hous sewage may have been the source. The seriousnes of water pollution and some of its ramifications ar evident. An education program on water pollutio is recommended. (White-Iowa State)
W71-04919

OBSERVATIONS ON THE EFFECT OF TH RE-USE OF BROILER LITTER ON THE IN CIDENCE OF MAREK'S DISEASE,
Delaware Univ., Newark.
For primary bibliographic entry see Field 05C.
W71-04927

WATER SUPPLY MANAGEMENT PLAN FO MUSKEGON COUNTY,
Muskegon County Metropolitan Planning Commis sion, Mich.; and Bauer Engineering, Inc., Chicago Ill.

or primary bibliographic entry see Field 06B.
V71-04945

G. Water Quality Control

LOW THROUGH A TAILINGS POND EMANKMENT,
ureau of Mines, Spokane, Wash., and Idaho niv., Moscow.
or primary bibliographic entry see Field 08D.
71-04862

ONTROL OF WATER POLLUTION DURING AM CONSTRUCTION,
alifornia State Dept. of Water Resources, Sacraento; and Santa Ana Regional Water Quality ontrol Board, Riverside, Calif.
harles A. McCullough, and Robert R. Nicklen.
SCE Proceedings, Journal of the Sanitary Engeering Division, Vol 97, No SA 1, Paper 7927, p -89, February 1971. 9 p, 3 fig, 4 ref, append.

escriptors: *Water pollution control, *Dam conuction, *Excavation, *Construction, Silts, Clays, ly water, Environmental engineering, Silting, dimentation, Water pollution sources.
entifiers: Dam construction problems.

ith proper planning, owners can avoid water polion from sediments and sludge during the conuction of dams, cofferdams, docks, bridges, ers, culverts, dikes, weirs, or retaining walls near ers, streams, or other water ways. Prior to conuction they should consider how silts, clays, oils, ments, and other materials might enter the eam from haul roads, from erosion of excavation eas, earthfill, and spoil piles, or during the ocesses of clearing reservoirs or of diverting eams around foundations. They must consider effect of construction procedure upon inage, public water supply, recreational facilis, the fishery, and esthetics. Working with agens charged with the protection of specific stream es and with the maintenance of water quality ndards, they should specify appropriate pollun control measures in construction contracts and ould make certain that bidders understand them. ntract specifications related to pollution control given. (Knapp-USGS)
71-04888

AN AND HIS ENVIRONMENT, VOLUME 1.
lgary Univ. (Alberta).

A. Ward, editor. Proceedings of the First Banff nt Conference on Pollution, The university of lgary and the Engineering Institute of Canada, y 16-17, 1968, Banff, Alberta, Canada. New rk, N.Y., Perganion Press, Inc., 1970. 196 p.

scriptors: *Conferences, *Water pollution, *Air lution, *Environmental effects, Water pollution rces, Industrial wastes, Municipal wastes, Farm stes, Domestic wastes, Pollutants, Pollution tement, Planning, Water pollution control.
ntifiers: *Conference (Banff, Canada).

e purpose of the First Banff, Canada conference to bring together all parties who have an inest in environmental pollution but at different els; the politicians, the planners, the industrits, the engineering profession, the biologists and medical profession. It was hoped that the inchange of ideas between the various groups uld lead to a clearer understanding of the whole blem by all and thus assist in its solution, in any en circumstances. Seventeen technical papers ering the political, legal, medical and some eral aspects of the overall problem of pollution e submitted by prominent and concerned men n throughout Canada and the United States. se proceedings document the formal program ne Conference. The main topics for the four ses s were as follows: (1) General; (2) Water pollu , (3) and (4) Air Pollution and Urban Waste. e also W71-04902 and W71-04903) (Woodard-GS)

W71-04901

LIQUID WASTE IN THE PULP AND PAPER INDUSTRY,
Stanley Associates Engineering, Ltd., Edmonton (Alberta).
For primary bibliographic entry see Field 05D.
W71-04902

PETROCHEMICAL WASTE DISPOSAL,
Department of Health, Edmonton (Alberta).
For primary bibliographic entry see Field 05E.
W71-04903

AGRICULTURE FACES NEW CHALLANGES IN CURRENT ENVIRONMENTAL CRISES,
Department of Agriculture, Washington, D.C. Science and Education.
Ned D. Bayley.
Water and Wastes Engineering, Vol 7, No 11, p F-14 - F-16, November 1970. 4 fig.

Descriptors: Farm wastes, Water, Water resources, Pesticides, Salinity, Sediments, Water pollution control, Fertilizers, Planning.
Identifiers: Soil spoiler.

The responsibility of agriculture in enhancing the quality of the environment is colossal. This is because agriculture, including forestry, involves more natural resources than any other segment of society. Wise planning in the use of land, water, chemicals, and waste disposal techniques must be demanded, and it must be done now. This paper outlines some of the problems and difficulties encountered in dealing with agricultural pollutants. (Christenbury-Iowa State)
W71-04914

OIL POLLUTION DAMAGE TO NAVIGABLE WATERS AND MARINE LIFE GIVES RISE TO MARITIME LIEN WHICH WILL SUPPORT ADMIRALTY ACTION IN REM.
For primary bibliographic entry see Field 06E.
W71-04983

OIL POLLUTION AT SEA,
John O. Ludwigson.
In: Oil Pollution: Problems and Policies, Bureau of National Affairs, Inc, Washington, DC, p 1-20, 1969. 20 p, 1 tab.

Descriptors: *Water pollution, *Oily water, *Ships, *Oil, Legal aspects, Water pollution sources, Water pollution control, Water pollution treatment, Oil industry, Oil wastes, International law, Oceans, Remedies, Legislation, Treaties, International waters, United States, Foreign countries, Foreign waters, Emulsifiers, Detergents, Chemical wastes, Accidents, Rivers and Harbors Act.
Identifiers: *Oil spillage.

After detailing the Torrey Canyon and Ocean Eagle oil spills in England and Puerto Rico, respectively, and delineating the attempts by those governments to clean up the oil and protect the ecology, this article observes that the Torrey Canyon and Ocean Eagle spills are potentially small compared to a spill by a supertanker. In the discussion of legal aspects which follows, the author generalizes that: (1) oil spills are illegal almost everywhere; and (2) a polluter is liable for all costs and damages resulting from the spill. The impact of the Oil Pollution Act of 1961, and Boundary Water Treaty with Great Britain, the Oil Pollution Act of 1924, the Refuse Act, the Federal Water Pollution Control Act, and the Outer Continenal Shelf Lands Act upon oil spills is discussed. It is noted that improved navigation devices and ship design should prevent spills. In a discussion of control and cleanup of spills, the article discusses: (1) physical collection; (2) use of absorbents; and (3) chemical dispersion. A table of chemical emulsifiers for oil dispersion concludes the article. (See also W71-04988) (Hart-Florida)
W71-04989

OIL POLLUTION AND THE LAW,
Max N. Edwards.
In: Oil Pollution: Problems and Policies, Bureau of National Affairs, Inc, Washington, DC, p 21-30, 1969. 9 p.

Descriptors: *Water pollution, *International law, *Water pollution control, *Oil, Oily water, Legal aspects, Ships, Water pollution sources, Oil industry, Oil wastes, Oceans, Remedies, Legislation, Treaties, International waters, United States, Foreign countries, Foreign waters, Pollution abatement, Accidents, Rivers and Harbors Act, International commissions.
Identifiers: *Oil spillage, Water Pollution Control Act.

Noting that the gap between oil technology and law must be closed, this article stresses the dual national and international nature of the oil pollution problem. Viewing the legal capability of dealing with oil pollution, the author discusses: (1) the 1954 International Convention for the Prevention of Pollution of the Seas by Oil, (2) the 1961 Oil Pollution Act, (3) the Federal Water Pollution Control Act, (4) the 1924 Oil Pollution Act, and (5) the Convention on the Territorial Sea and the Contiguous Zone. The author sets forth the specific changes necessary to close the gap and put oil under legal control both in the United States and the international arena: (1) change from a gross negligence or willful standard of liability for oil discharge at sea to a strict liability standard; (2) attach liability to offshore drilling spills; and (3) provide enforcement authority for the Intergovernmental Maritime Consultive Organization. Financial responsibility for oil discharge is strongly advocated. A carrier should be strictly liable for any oil pollution on the seas, and proof of financial responsibility should be required. The author also advocates an international standard for construction of oil tankers. (See also W71-04988) (Hart-Florida)
W71-04990

OIL SPILLAGE PREVENTION, CONTROL, AND RESTORATION--STATE OF THE ART AND RESEARCH NEEDS,
W. H. Swift, C. J. Touhill, W. L. Templeton, and D. P. Roseman.
In: Oil Pollution: Problems and Policies, Bureau of National Affairs, Inc, Washington, DC, p 31-61, 1969. 30 p, 1 fig.

Descriptors: *Water pollution, *Oil, *Technology, *Water pollution effects, Design, Research and development, Materials engineering, Materials testing, Emulsifiers, Detergents, Chemical wastes, Organic wastes, Water pollution sources, Water pollution control, Water pollution treatment, Oil industry, Oily water, Oil wastes, Accidents.
Identifiers: *Oil spillage.

Topics discussed in this article on oil spillage, resulting both from tankers and from offshore production operations, include: (1) technical aspects of tank-vessel design as related to prevention of oil spillage, (2) on-scene control of gross leakage, (3) destruction or recovery of open sea oil slicks, (4) disposal of recovered mixtures, (5) protection of the shore face and estuaries, (6) cleaning of shore face and estuaries, (7) slick surveillance and behavior prediction, (8) effect of oil pollution and treatment agents on marine flora and fauna, and (9) waterfowl recovery methods. The review and analysis is directed primarily toward the technical aspects of oil spillage prevention. The current state of technology is discussed, and specific recommendations are made for research and development in the areas of: (1) contingency plans, (2) oil and hazardous materials information centers, (3) prevention of oil spills, (4) control of oil spillage, (5) restoration, and (6) effects of spillage. (See also W71-04988) (Hart-Florida)
W71-04991

OIL POLLUTION: A REPORT TO THE PRESIDENT.

In: Oil Pollution: Problems and Policies, Bureau of National Affairs, Inc, Washington, DC, p 62-109, 1969. 48 p, 1 bibl.

Descriptors: *Water pollution control, *Oil, *United States, *Pollution abatement, Oily water, Water pollution, Planning, Federal government, Administrative agencies, Water pollution sources, Water pollution treatment, International law, International waters, Oil industry, Legislation, Oceans, Oil wastes, Research and development, Resources, Costs, Transfer, Storage, Pipelines.
Identifiers: *Oil spillage.

Considering it imperative that action be taken to prevent oil pollution catastrophies, the President of the United States directed a study to examine how the resources of the United States could best be mobilized against oil pollution. The resulting report to the President first relates recent oil spillage disasters, such as the Torrey Canyon, and discusses the major sources of danger from oil pollution. Topics analyzed include: (1) water borne sources, (2) waste oils, (3) industrial transfer and storage, (4) pipelines, and (5) offshore mining. The present capabilities of the nation are delineated as relate to: (1) prevention, including legal aspects, technical aspects, industrial aspects, and surveillance and notification; (2) cleanup, including contingency plans, physical cleanup operations, physical and technical capabilities, needed improvements in cleanup capability, and legal aspects of cleanup and cost recovery; (3) action programs; (4) activities underway; and (5) recommendations for early action. The report recommends more effective application of existing technology and, through expanded research and development, improvement of present technology and procedures. (See also W71-04988) (Hart-Florida)
W71-04992

NATIONAL MULTI-AGENCY OIL AND HAZARDOUS MATERIALS POLLUTION CONTINGENCY PLAN.

In: Oil Pollution Problems and Policies, Bureau of National Affairs, Inc, Washington, DC, p 110-134, 1969. 24 p.

Descriptors: *Water pollution, *Oil, *Pollution, *Planning, Oily water, Federal government, Administrative agencies, Administrative decisions, Coordination, Water pollution control, Water pollution sources, Water pollution treatment, International law, International waters, Oil industry, Oceans, United States, Oil wastes, Legislation.
Identifiers: *Oil spillage, *National Pollution Contingency Plan.

President Johnson directed preparation of the National Multi-Agency Oil and Hazardous Materials Pollution Contingency Plan. This chapter in a book on oil pollution problems and policies consists of excerpts from this plan. Effective for all United States navigable waters, the purpose of the plan is to establish a pattern of coordinated and integrated responses to pollution incidents. A national reaction team is established, and federal response operations are divided into four phases: (1) discovery and notification; (2) containment and countermeasures; (3) cleanup, restoration, and disposal; and (4) recovery of damages and enforcement. An on-scene commander, an executive agent, is predesignated to coordinate and direct pollution control activities. Numerous annexes are included in the Plan, titled as follows: (1) summary of legal capabilities available to control oil pollution; (2) national inter-agency committee; (3) joint operations center; (4) ship salvage authority of the U. S. Navy; (5) communications and reports; (6) state and local government and private interests; (7) funding, (8) procedures for reporting information and collecting samples in phase IV operations; and (9) technical information. The federal policy on the use of chemicals to treat floating oils is included. (See also W71-04988) (Hart-Florida)
W71-04993

A SUMMARY OF MASSACHUSETTS STATE LAWS, POLICIES AND PROGRAMS PERTAINING TO WATER AND RELATED LAND RESOURCES.
Massachusetts Water Resources Commission, Boston. Div. of Water Resources.
For primary bibliographic entry see Field 06E.
W71-04996

ACID MINE DRAINAGE RESEARCH AT THE OHIO STATE UNIVERSITY,
Ohio State Univ., Columbus. Dept. of Chemical Engineering.
Edwin E. Smith.
Proceedings, Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol LII, No 3, p 229-240, July 1968. 7 fig, 10 ref. FWPCA Grant WP-00340; OWRR Projects W101 and W102.

Descriptors: *Pyrite, *Iron compounds, Sulfur compounds, Acid water, Mine wastes, Water pollution sources, *Mine drainage, *Oxidation, Waste water treatment, Water pollution control, Ohio.
Identifiers: Pyrite oxidation, Venton County (Ohio).

Ohio State University has been involved in acid mine drainage work since 1956 and a short history of their involvement in this field is discussed. From past experience and discussion of specific projects, an interdisciplinary team approach is still required. Chemical mechanism and microbiological studies were conducted which led to studies of pyrite oxidation on a pilot-plant scale. (Ellis-Texas)
W71-04999

CONTROL OF WATER AT STRIP MINING OPERATIONS THROUGH SOUND MINING AND RECLAMATION PRACTICES,
Peabody Coal Co., St. Louis, Mo. Forestry and Water Quality.
J. A. Deane.
Proceedings Industrial Waste Conference, 21st, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 1-3, March 1966. 4 ref.

Descriptors: *Waste disposal, *Mine acids, *Mine drainage, Acid mine water, Mine wastes, Hydrogen ion concentration, *Water reuse, Waste water treatment, Water pollution control.
Identifiers: Diversion ditches, Gob, Coal wastes.

A short discourse of mine water was conduced indicating there are two separate parts to water control at strip mine operations; (1) the handling of wastes from the cleaning plant, and (2) the handling of water at the pit itself. If water from a strip mining operation is handled by the sound mining and reclamation practices outlined in this article there will be no pollutional problem in the receiving streams. (Ellis-Texas)
W71-05036

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 2, SECTION B-HYDROLOGY,
Wisconsin Univ., Madison. Water Resources Center.
A. J. MacCormick, and Gerald J. Stadler.
Available from the NTIS as PB-197 847, $3.00 in paper copy, $0.95 in microfiche. Technical Report OWRR C-1228, 1970. 42 p, 13 fig, 6 tab. OWRR Project C-1228-WIS (1601) (2).

Descriptors: *Water management (Applied), *Rivers, *Reservoirs, *Reservoir operation, Wisconsin, Hydrologic aspects, Industrial plants, Hydrographs, Reservoir storage, Detention reservoirs, Drawdown, Early impoundment, Recreation, Water levels, Late impoundment, River forecasting, Flood control, Low-flow augmentation, Regulated flow, Hydrologic models, Streamflow, Water quality, Computer programs.
Identifiers: *Wisconsin River (Wis).

The physical features of the Wisconsin River Ba and the development of the river and its tributari are described together with its utilization hydroelectric plants, pulp and paper mills, other i dustries, agriculture, municipalities, and recre tionists. The storage reservoir system is examin in order to describe the determination of observ flows as a result of reservoir operating rules, co trol points, seasonal factors and constraints on t system. A simulation model of the flow patterns developed in order to analyze the effects of flo variation on water quality. Much of the fiscal co putation is done manually since the objective is obtain answers for representative water years ha ing high, medium, and low flow rather than to wri a generalized computer program. Using historic data records on storage and flow, a streamflo routing program represents the existing system storage reservoirs together with the river and tributaries, and permits alternative procedures f controlling the reservoir levels or for controllin the rate of flow at specific gaging stations. method for estimating flow augmentation capaci is described. (See also W71-05038 thru W7 05041). (Dorcey-Wisconsin)
W71-05037

INSTITUTIONAL DESIGN FOR WATE QUALITY MANAGEMENT: A CASE STUDY C THE WISCONSIN RIVER, VOL. 4, SECTION E COST FUNCTIONS FOR INFLUENCIN WATER QUALITY; SECTION F - RELATIO OF PARTICIPATION IN OUTDOOR RECRE TION AND PUBLIC ATTITUDES TOWAR WATER QUALITY,
Wisconsin Univ., Madison. Water Resourc Center.
Elizabeth L. David, Richard S. Howe, and John T. Quigley.
Available from NTIS as PB-197 845, $3.00 paper copy, $0.95 in microfiche. Technical Repo OWRR C-1228, 1970. 101 p, 7 fig, 34 tab, 38 re append. OWRR Project C-1228-WIS (No 160 (3).

Descriptors: *Water quality control, *Costs, *Est mating, *Wisconsin, *Recreation, *Attitudes, S cial aspects, Economics, Water pollution contro Water quality, Waste water treatment, Reaeratio Flow augmentation, Reservoirs, Property value Cost-benefit ratios, Cost analysis, Surveys, Wat pollution effects, Reservoir storage.
Identifiers: *Wisconsin River (Wis), Joint trea ment plants.

The first section of this volume (E) describes th estimation of the cost functions for influencir water quality and the second section (F) outline the relation of the participation in outdoor recre tion and public attitudes toward water quality. Co functions for influencing water quality through th following alternatives are developed: extern treatment by municipalities, external treatment f pulp and paper mills, joint facilities, and mechan cal aeration. While the cost estimates for mu nicipalities are based on regression curves, the est mate for the mills' joint facilities and aeration ar engineering cost-estimates. In the case of the mu nicipalities and the mills discrete levels of primar and secondary treatment are considered. In orde to estimate the economic efficiency of joint facil ties, estimates were made for the cost of pipeline and joint municipal and mill waste treatment. En gineering-cost estimates are made for mechanic aeration through turbine venting and in-strea aeration. Finally regression estimates were mad for the reduction in shoreland values of storag reservoirs resulting from releases for flow augmen tation. Section F reports the conclusions of a su vey which attempts to identify public definitions o water pollution and participation in water-base outdoor recreation in Wisconsin. (See also W7 05037). (Dorcey-Wisconsin)
W71-05038

NSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 5, SECTION G - SYSTEMS ANALYSIS OF HYDROPOWER PRODUCTION ON THE WISCONSIN RIVER,
Visconsin Univ., Madison. Water Resources Center.
Gary G. Storey.
Available from NTIS as PB-197 846, $3.00 in paper copy, $0.95 in microfiche. Technical Report OWRR C-1228, 1970. 299 p, 27 fig, 54 tab, 40 ref, append 5A, 5B, 6A, 6B. OWRR Project C-1228-WIS (No 1601) (4).

Descriptors: *Powerplants, *Hydroelectric plants, Economics, Power operation and maintenance, lectric power production, Electric power demand, Reservoirs, Model studies, Simulation analysis, Hydroelectric power, Water quality, Water resources development, Water resources, Costs.
Identifiers: *Wisconsin River (Wis).

esearch was made to determine economic cost of ydropower benefits lost due to alteration of river ows to achieve quality objectives and examination f the value of capacity and energy of the Wisconn River hydropower plants. The methodology in easuring hydropower value was based on the least stly alternative of supplying equivalent electrical nergy and capacity, within the context of the overi electricity generating system relying primarily thermal generation and composed of both ublic utilities and industries generating power for eir specific use. A computer simulated operaonal model used general hydropower production nction and regression equations to estimate the oduction functions of the system's 26 ydropower plants. Models representing electricity oduction for the component electric utility stems were based on projections of peak energy mands and total energy demands per month, and ojected generation station additions and retirement for the 1970-1990 period. The conclusion is at 1/2 of the hydropower plants were economic producers of electricity due to smaller e, age, and high operational and maintenance sts. However, hydropower is an economical urce of electricity for pulp and paper mills when mpared to the alternative of purchasing energy. is study is particularly relevant to the Wisconsin ver. (See also W71-05037). (Auen-Wisconsin)
71-05039

STITUTIONAL DESIGN FOR WATER UALITY MANAGEMENT: A CASE STUDY OF IE WISCONSIN RIVER, VOL. 7, SECTION I - VE LEGAL STUDIES ON WATER QUALITY ANAGEMENT IN WISCONSIN,
isconsin Univ., Madison. Water Resources nter.
ter N. Davis.
ailable from NTIS as PB-197 850, $3.00 in per copy, $0.95 in microfiche. Technical Report VRR C-1228, 1970. 371 p, 1 tab, append A, B, D, E, F. OWRR C-1228-WIS (No 1601) (5).

scriptors: *Legal aspects, *Legislation, *Water llution control, *Wisconsin, Regulation, nagement, Water quality, Administration, Con-l, Judicial decisions.
ntifiers: *Wisconsin River Basin (Wis).

ese studies illuminate the implications of existing for the establishment of a regional system of ter quality management in the Wisconsin River sin. Two studies examine Wisconsin experience der existing law. One of these reviews the appli-ion of the common law and how it has func-ned; the other reviews Wisconsin experience in ulating water pollution by the Division of En-onmental Protection of the Department of Natu- Resources, and the work of conservation rdens in dealing with individual pollution cases. ree studies examine the effects of certain con-utional limitations for possible institutional nges that might be made to manage water quali-The first of these is concerned with the constitunal limitations on the construction and operation of water pollution abatement facilities. The second reviews four alternatives to divert state action to construct and operate such facilities, namely, by a state owned non-profit corporation, a special district, a private corporation, and a cooperative. The third study investigates the constitutional limitations on the use of effluent charges to regulate water pollution. (See also W71-05037). (Fox-Wisconsin)
W71-05040

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 9, SECTION K - AN ANALYSIS OF ALTERNATIVE INSTITUTIONAL PATTERNS FOR MANGING WATER QUALITY ON A REGIONAL SYSTEM BASIS,
Wisconsin Univ., Madison. Water Resources Center.
David C. Ranney.
Available from NTIS as PB-197 848, $3.00 in paper copy, $0.95 in microfiche. Technical Report OWRR C-1228, 1970. 250 p, 6 fig, 1 tab. OWRR Project C-1228-WIS (No 1601) (6).

Descriptors: *Administrative agencies, *Planning, *Wisconsin, *Design criteria, *Management, Coordination, Decision making, Inter-agency cooperation, Organizations, Water quality, Social function, Design, Water quality control, Political aspects, Administration, Water law, Non-structural alternatives.
Identifiers: *Systems concept, *Wisconsin River (Wis), Institutional design, Regional systems.

This study is concerned with the design of administrative arrangements for managing water quality on a regional system basis. It reviews existing water quality decision-making arrangements and presents two case studies on water quality management decisions in Wisconsin to indicate how groups and political parties have functioned in dealing with water quality management. The implications of the regional system approach for the design of administrative arrangements are then examined and design criteria for such arrangements developed on the basis of the current literature on organizational theory. These criteria are then applied in an evaluation of three alternative administrative models. One of these is a simple extension of existing arrangements with the existing Department of Natural Resources operating the regional system. In the second, a regional water quality management agency is envisaged as operating the regional system with the Department of Natural Resources establishing and enforcing standards. The third alternative, characterized as the inter-organizational model, would involve four agencies including a regional management agency, a quasi-judicial body to issue orders and enforce regulations, a conservation-oriented planning and standard-setting agency, and a development-oriented planning and standard setting agency. (See also W71-05037). (Fox-Wisconsin)
W71-05041

POTENTIAL ALGICIDES FOR THE CONTROL OF ALGAE,
Los Angeles County Sanitation District, Calif.
James C. Gratteau.
Water and Sewage Works, 1970 Reference Number, Vol 117, p R24-R61, November 28, 1970. 17 p, 6 tab, 27 ref.

Descriptors: *Algicides, *Water quality control, *Aquatic weed control, *Domestic water, *Surface waters, Water supply, Eutrophication, Algae, Nutrients, Water pollution, Biological treatment, Chemicals, Copper sulfate, Chlorine, Water resources, Methodology, Evaluation, Chemical analysis.
Identifiers: Rosin amine D acetate (RADA).

Problems concerning algae in water supplies and methods of controlling algae growth are discussed. In general, there are three basic methods of algae control: physical, ecological and chemical. Physical methods of control, raking, dragging, pulling, and underwater mowing have been used mainly on floating masses of algae and rooted aquatics. Ecological control of algae involves limitation of one or more of the factors necessary for growth and reproduction: light or nutrient material. Only two chemicals are widely used to control algae in water supplies, copper sulfate and chlorine. In excessive concentrations copper sulfate may poison fish and other aquatic life. Approximately 300 chemicals were screened for toxicity and their effectiveness compared with that of copper sulfate. Data for some of the most promising chemical compounds (for example, rosin amine D acetate) as determined from preliminary screening tests and toxicity studies are tabulated. A bibliography with 418 references is included. (Woodard-USGS)
W71-05083

A SURVEY OF CALIFORNIA COASTAL POWER PLANTS,
Federal Water Pollution Control Administration, Portland, Oreg.
R. W. Zeller, and R. L. Rulifson.
January 1970. 64 p, 16 fig, 4 ref.

Descriptors: *Thermal powerplants, Thermal pollution, Cooling water, *Environmental effects, Intakes, Fishkill, Heat treatment, Temperature, Water pollution effects, *California, Coasts, *Powerplants, Sites, Operations.
Identifiers: *Coastal powerplants, Siting, Shoreline outfalls, Outfalls, Policy.

The Northwest Regional Office, FWPCA, initiated a tour in May, 1969 to obtain information on the sites, operation, and environmental effects of representative coastal powerplants in California. Out of the ten powerplants visited, nine are gas-oil fueled and the tenth is nuclear fueled. The purpose of these surveys is to facilitate development of waste heat discharge requirements and to document environmental changes due to heated discharges and the possible need for changes in discharge requirements. Pacific Gas and Electric Company and S. C. Edison Company have developed standard procedures for the design of intake structures to minimize the losses of small fish. Shoreline intakes reduce fish losses by avoiding the high conduit velocities associated with offshore intakes. The powerplants visited subject their cooling water intake systems to periodic heat treatment to control mussels, clams and other incrustations. Based on temperatures at least 4F above ambient, the heated discharge from the outfalls may effect volumes of water up to 100 acres in area and up to 15 feet thick. A lack of well-defined policies and coordination in regard to site evaluation will preclude considerations of the marine environment as a major factor in the location, design, and operation of powerplants. (Upadhyaya-Vanderbilt)
W71-05118

THERMOELECTRIC GENERATORS POWERED BY THERMAL WASTE FROM ELECTRIC POWER PLANTS,
Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest, Water Lab.
For primary bibliographic entry see Field 08C.
W71-05121

NEW JERSEY V CITY OF NEW YORK (CITY DUMPING GARBAGE IN OCEAN AS NUISANCE).
For primary bibliographic entry see Field 06E.
W71-05125

SURFACE HEAT EXCHANGE AT POWER PLANT COOLING LAKES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography., Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering.
D. K. Brady, W. L. Graves, and J. C. Geyer.
Cooling Water Discharge Project Report No 5, Edison Electric Institute, New York, November 1969. 154 p, 61 fig, 7 tab.

Descriptors: *Thermal pollution, *Cooling water, *Power plants, Forecasting, Winds, Dewpoint, Computers, Diffusion, Solar radiation, Hydraulics, Water pollution control, Cooling, Temperature.
Identifiers: *Heat exchange, Exchange coefficient, Equilibrium, Cooling ponds.

This report describes analytical methods for computing rates of surface heat exchange at power plant cooling lakes. The preparation of data for computer analysis is summarized, and computer produced graphs are extensively used to demonstrate characteristics of the data and relationships for evaluating exchange coefficients and equilibrium temperatures. The main results of the study were: (1) the capacity for cooling lakes to dissipate heat under low wind speed conditions is shown to be appreciable. (2) The equilibrium temperature is shown to be closely approximated by the dewpoint temperature .. (solar radiation divided by exchange coefficient.) The application of these findings to the design of power plant cooling lakes and to the evaluation of hydraulic diffusion rates is discussed. (Upadhyaya-Vanderbilt)
W71-05134

ENVIRONMENTAL MONITORING - BRITISH POLICY AND PROCEDURES,
United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.
For primary bibliographic entry see Field 05A.
W71-05135

BENEFICIAL USE OF WASTE HEAT-AN EVALUATION,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
R. R. Garton, and A. G. Christianson.
Paper for presentation at Conference on Beneficial Uses of Thermal Discharges, New York State Department of Environmental Conservation, September 18, 1970. 12 p. FWQA Program 16130 FHJ 9/70.

Descriptors: *Thermal pollution, *Beneficial use, Temperature, Organic wastes, Economics, Cooling water, Irrigation, Powerplants, Water pollution control.
Identifiers: *Waste heat, Aquaculture, Space heating.

In the overall environmental ecological framework, a beneficial use of waste heat must help reduce the thermal pollution problem directly or it must provide a profit to help offset the cost of cooling devices. Only aquaculture, agriculture and integrated agro-industrial complexes fit this categorization. There is a successful small scale commercial plant in Texas where catfish are raised in cages in a powerplant discharge canal which maintains suitable temperature for optimum growth. Marine fishes have been raised in warmed sea water in Scotland and shrimp in warm powerplant effluent in Florida. The problem of organic pollution has been largely ignored in past aquaculture studies. In a recently completed study in the Pacific Northwest, it was found that 114 hatcheries were releasing approximately 23 tons of BOD per day. In the future a more conscious optimization of distribution, irrigation and heating systems will be required. Pollutional side effects of warm water irrigation could include, changes in temperature or chemical characteristics of groundwater, spreading of pesticides and stream warming through short circuiting of return water. Another possible use of waste heat is spaceheating. The two discouraging factors for this use are the low temperature of typical powerplant waste water and relatively low load factor of space heating systems. (Upadhyaya-Vanderbilt)
W71-05139

NEW JERSEY V CITY OF NEW YORK (OFFSHORE SEWAGE SLUDGE DISPOSAL).
For primary bibliographic entry see Field 06E.
W71-05146

PERMITS FOR DISCHARGES OR DEPOSITS INTO NAVIGABLE WATERS.
Corps of Engineers, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-05184

ECOLOGY OF SCHISTOSOME DERMATITIS IN WESTERN AND NORTHERN NEVADA WATERS,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 05A.
W71-05194

SINCLAIR REFINING CO V BENNETT (POLLUTION OF WELLS BY GASOLINE LEAK).
For primary bibliographic entry see Field 06E.
W71-05207

WATER QUALITY, THE STATE OF THE ART,
Wayne State Univ., Detroit, Mich.
Henry Dirasian.
Urban Affairs, Vol 6, No 2, p 199-212, Dec 1970.

Descriptors: *Water quality, Water supply, Water pollution, Waste water treatment, Biochemical oxygen demand, Tertiary treatment, Cost allocation.
Identifiers: *Recycling, Disposal costs.

The problems of water pollution control and solid waste disposal are considered. An analysis of the technology of primary and secondary waste water treatment is given with the main impact of secondary treatment being on the further reduction of biochemical oxygen demand (BOD) of the waste water. Techniques for tertiary treatment are described with stress on filtration techniques and electrical processes. The author compares solid waste disposal and waste water treatment and suggests solid waste recycling can be profitable while waste water treatment costs are a municipal burden. Water quality standards established by the State of Michigan Water Resources Commission are discussed by the author to illustrate the relation between uses of streams and the amount of contaminants allowable for water supply, recreational, agricultural, and commercial purposes. The author finds waste water treatment problems are no longer of a technical nature but due mainly to insufficient cost allocation by municipalities and industrial plants. (Siegenthaler-Rutgers)
W71-05212

THE QUALITY OF THE URBAN ENVIRONMENT,
California Univ., Los Angeles.
For primary bibliographic entry see Field 06G.
W71-05214

SPECIAL PROBLEMS OF METROPOLITAN WATER RESOURCES ANALYSIS,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06B.
W71-05225

REGIONAL WASTE WATER MANAGEMENT SYSTEMS,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05D.
W71-05227

LINEAR PROGRAMMING MODELS FOR WATER POLLUTION CONTROL,
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks, Charles S. Revelle, and Walter R. Lynn.
Management Science, Vol 14, No 4, p 166-181, December 1967.

Descriptors: *Linear programming, Water pollution control, Stream flow, Waste water treatment, Biochemical oxygen demand, Oxygen sag, Economic evaluation.
Identifiers: *Cost minimization, Objective fu
tion, Linear constraint, Differential equation.

Two linear programming models are presented
discover the least cost combination of waste w
treatment facilities required to meet any se
stream dissolved oxygen standards within a r
basin. The dissolved oxygen parameter of stre
quality is used to measure and limit the amoun
pollution resulting from organic wastes.
models are derived from the Streeter-Phelps
ygen sag equations used to describe the rates of
solved oxygen depletion and recovery of strea
The solution of the models indicates the design
ciencies required for each waste water treatm
facility in order to maintain a specified set of
ygen concentrations. These models can be use
evaluate the sensitivity of cost and quality to
changes in stream and waste water flow conditi
The models can point out those locations alon
stream where the discharge of waste water efflu
results in a minimum increase in the total cos
the required waste water treatment. (Siegentha
Rutgers)
W71-05236

THE INDUSTRIAL POINT OF VIEW,
Iowa Univ., Iowa City.
H. Sidwell Smith.
In: Water Pollution Control and Abatement, An
Iowa State University Press, 1967, p 134-144.

Descriptors: *Industrial wastes, *Water polluti
*Economic evaluation, Municipal wastes, Wa
treatment, Cost-benefit analysis, Water qua
standards, Surface runoff, Sewerage, Technolo
Social aspects, Population.
Identifiers: *Iowa, Economic base, Industrial wa
trends, Economic growth.

Iowa industry generates an amount of orga
wastes which have a pollution effect of more th
twice the present population. In addition, a la
amount of inorganic waste is also present. Ho
ever, the present situation is such that the nature
control and regulation can be largely prevent
rather than exclusively corrective. This is due
the relatively even distribution of industrial activ
throughout the state. The principal problems
those associated with formulation and implemen
tion of policy concerning the use of the stat
water resources. Conflicting uses must be eva
ated and the effect of different waste constitue
on other uses of water resources analyzed. Uniq
problems are created by the differences in
economic base between industrial and public are
and these must be recognized in cost-bene
analyses and method comparison. The tendency
these differences to favor low-investment ope
tions with high operating costs must be prevente
(Murphy-Rutgers)
W71-05242

**WATER QUALITY AND MAN'S ENVIRO
MENT,**
Federal Water Pollution Control Administratio
Kansas City, Mo.
Herbert C. Clare.
In: Man and the Quality of His Environme
Boulder, University of Colorado Press, 1968, p 4
58.

Descriptors: *Water pollution, *Waste treatme
*Federal government, Costs, Economic evaluatio
Water quality, Management, Population technol
gy, Water law, Social aspects, Waste treatment.
Identifiers: *Economic growth, *Waste philosoph

A review is conducted on the federal governmen
role in controlling water pollution, and the chang
in public attitude toward water resources broug
about by changes in the economic environment ar
the need for efficient water management. Th
Water Quality Act of 1965 and the Clean Wat
Restoration Act of 1966 have marked change
public awareness of the problem brought about b
increased population paralleling in industrial ar

hnological expansion. The economic progress of cent years has changed water from a free good to e whose cost is steadily rising. The relevant estion is whether this cost should be borne by the ter user or the waste discharger. The author cusses this basic problem and argues in favor of latter approach. (Murphy-Rutgers)
1-05243

OCEEDINGS, CONFERENCE ON ZARDOUS CARGOES, U. S. COAST GUARD ADEMY, NEW LONDON, CONNECTICUT 8-9 JULY 1970.
ional Research Council, Washington, D.C. nmittee on Hazardous Materials.
primary bibliographic entry see Field 05B.
1-05260

E CONTROL OF ACID MINE DRAINAGE LLUTION BY BIOCHEMICAL OXIDATION D LIMESTONE NEUTRALIZATION TREAT-NT,
ional Coal Board, Yorkshire (England).
primary bibliographic entry see Field 05D.
1-05274

SEARCH AND DEMONSTRATION PRO-TS IN THE ABATEMENT OF ACID MINE AINAGE,
nsylvania Dept. of Health, Harrisburg.
Buscavage.
ceedings, Industrial Waste Conference, 20th, 4, 5, 6, 1965. Purdue University, Vol XLIX, 3, p 664-672, July 1965. 2 fig.

criptors: *Coal mine wastes, Mine acids, Min-Water pollution sources, Abatement, *Mine nage, Strip mine wastes, Pennsylvania, *Water ation control, Waste water treatment.
tifiers: Retreat mining, Monongahela River, uehanna River.

rief description of some of the twenty mine nage research or demonstration projects being ed out in Pennsylvania is presented. The ongahela River Mine Drainage Project, the El ton Strip Mine Reclamation Project, the Wet-e Coal Study, Retreat Mining, the Tom's Run ect, the Slippery Rock Creek Survey, the Coal arch Board Projects, the Buttonwood Over-Study, the Butler Water Tunnel Study, the Augmentation Study, and the Watershed amation Demonstration Project are discussed. -Texas)
-05279

TER PROBLEMS IN OIL PRODUCTION,
Case.
, Oklahoma, Petroleum Publishing Company, 133 p.

riptors: *Flooding, *Oil industry, *Water pol-n, Oily water, Water quality, Pitting (Corro-, Scaling, Brackish water, Water analysis.
ifiers: *Oil-field waters, Filtration, Common flood problems, Waterflooding, Pollution ance, Corrosion prevention, Graphitic corro-Sweet-oil (Organic acid) corrosion, Carbon de corrosion.

book is the first definitive volume ever shed on oil-field water problems. It embraces than 40 years of intensive experience with a er of petroleum companies and in a variety of ions. Following an uncomplicated discussion ter chemistry, the book covers solid deposits scale formations, and corrosion causes, ntion and treatment. Subjects such as ing or fouling deposits, filtration, identifica-of common water problems, and injection-specifications are examined in detail. Atten-also given to avoiding pollution, combatting claims, and to establishing criteria for ating qualified services for water problems. pbell-NWWA)
05295

SUMMARY OF OUR PRESENT KNOWLEDGE OF THE PHYSICAL PROCESSES OF MIXING IN THE OCEAN AND COASTAL WATERS, AND A SET OF PRACTICAL GUIDELINES FOR THE APPLICATION OF EXISTING DIFFUSION EQUATIONS IN THE PREPARATION OF NUCLEAR SAFETY EVALUATIONS,
Atomic Energy Commission, Washington, D.C., AND Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Institute.
For primary bibliographic entry see Field 02L.
W71-05324

OIL SOAKED STRAW HARVESTING TECHNIQUES,
Marsan Corp., Elgin, Ill.
John D. Harper.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No 4040, p 249-251.

Descriptors: Oil wastes, *Absorption, *Mechanical control, *Cleaning, Water pollution control.
Identifiers: *Harvesting techniques, Straw, *Oil pollution, Coastal pollution.

Mechanical recovery of oil pollutants is reviewed with emphasis on straw as an absorbent material and methods for the harvesting of the oil soaked straw. State-of-the-art harvesting techniques are complicated by the many varying circumstances surrounding oil pollution incidents. The development of new harvesting equipment to be used by various types of vessels will permit wider and more effective usage of straw in oil pollution control. (See also W70-10035) (Ensign-PAI)
W71-05325

PREVENTION OF POLLUTION BY OIL AND HAZARDOUS MATERIALS IN MARINE OPERATIONS,
Coast Guard, Washington, D.C. Electrical Engineering Branch.
Albert G. Stirling.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C. American Petroleum Institute Publication No 4040, p 47-53. 2 tab, 1 ref.

Descriptors: *Pollution abatement, *Oil, *Accidents, *Legislation, Education, Engineering, Water pollution control.
Identifiers: Cleanup, Enforcement, Oil pollution, Hazardous materials pollution.

The causes of pollution by marine operations can be deliberate, carelessness, or unavoidable accidents. Corrective measures are discussed within the realm of necessity, effectiveness and practicality. The best solution is prevention when possible, and cleanup methods when prevention is unrealistic. Education, engineering and enforcement are needed to effect these solutions. Legislation and international treaties concerning pollution by marine operations is summarized. (See also W70-10035) (Ensign-PAI)
W71-05326

PORTLAND HARBOR EVALUATION,
Maine Port Authority, Portland.
A. Edward Langlois, Jr.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No. 4040, p 233-236.

Descriptors: *Oil wastes, *Water pollution control, *Harbors, *Cleaning, *Barriers, Mechanical control, Evaluation.
Identifiers: Oil pollution.

The Portland Harbor Pollution Abatement Committee Inc. submitted a study proposal to the Federal Water Pollution Control Administration and was awarded a grant to study mechanical and pneumatic barriers to contain spilled oil and means of removing the contained oil. The findings from this research will result in a unique manual for on-the-scene oil pollution control. Advanced testing will continue involving the movement of hundreds of vessels for the transportation and handling of petroleum products. Equipment manufacturers and leading figures in pollution control are participating in the study. (See also W70-10035) (Ensign-PAI)
W71-05327

EVALUATION OF DISPERSANTS,
British Petroleum Co. Ltd., London (England). Research and Technical Development Dept.
L. R. Beynon.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No. 4040, p 209-215. 4 fig, 3 tab.

Descriptors: *Oil wastes, *Water pollution control, Cleaning, Chemicals, Evaluation, Dispersion, *Oil-water interfaces, Oily water.
Identifiers: *Dispersants, Oil pollution.

The way in which dispersants work is that they change the interfacial properties of oil and water, breaking up an oil layer into very small droplets by agitation which is dispersed into the sea. Application and techniques for supplying agitation to the treated oil differ depending on whether the oil is floating or has come ashore. Often dispersants which are very effective for floating oil may be of no use in dealing with beach cleaning, however the reverse is not necessarily true. Separate methods of evaluating the effectiveness of dispersants at sea and on shore are indicated. (See also W70-10035) (Ensign-PAI)
W71-05328

EVALUATION OF THE EFFECTIVENESS OF OIL-DISPERSING CHEMICALS,
Federal Water Pollution Control Administration, Edison, N. J. Water Quality Lab.
T. A. Murphy, and L. T. McCarthy.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No 4040, p 199-207. 7 fig, 4 tab, 19 ref.

Descriptors: *Oil wastes, *Water pollution control, *Cleaning, Chemicals, Laboratory tests, Evaluation, Dispersion, *Emulsifiers, Oily water.
Identifiers: Effectiveness evaluations, *Dispersants, Oil pollution.

An evaluation method for the effectiveness of oil-dispersing chemicals has been developed. The apparatus was originally designed for Navy specification for solvent-emulsifiers and has been adapted to correspond to typical environmental conditions. Type of oil, composition of salt water solution, degree of agitation of chemical-oil mixture, and the amount of contact between chemical and oil before agitation were the conditions demonstrating most effect on dispersment. Results from this procedure (the Simulated Environmental Tank Test) are in accord with results from field tests. (See also W70-10035) (Ensign-PAI)
W71-05329

LABORATORY EVALUATION OF CHEMICAL OIL DISPERSANTS,
Ontario Water Resources Commision, Toronto.
A. Oda.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No 4040, p 193-197. 3 fig, 11 ref.

Descriptors: *Oil wastes, Water pollution control, *Cleaning, Chemicals, Laboratory tests, Evaluation, Dispersion, Oily water.
Identifiers: Effectiveness evaluations, *Dispersants, Oil pollution.

Methods to evaluate chemical oil dispersants for obtaining preliminary data as to their effectiveness as dispersants and the resulting problems from their use are presented. Most of the techniques are quite simple, such as, jar tests, bioassays, oxygen uptake measurements and threshold odor determinations. Data is of value when the selection of a dispersant must be made with only limited knowledge and experience. (See also W70-10035) (Ensign-PAI)
W71-05330

DISPERSANT TOXICITY TEST PROCEDURES,
Ministry of Agriculture, Fisheries and Food, Burnham-on Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 05C.
W71-05331

LIMITED OIL SPILLS IN HARBOR AREAS,
Naval Facilities Engineering Command, Norfolk, Va. Atlantic Div.
J. Stephen Dorrler.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C., American Petroleum Institute Publication No 4040, p 151-156. 5 fig, 11 ref.

Descriptors: *Oil wastes, *Cleaning, *Harbors, *Cost analysis, Costs, Water pollution control.
Identifiers: Limited spills, Oil removal costs, Oil pollution.

Limited oil spills are numerous and occur frequently, they require proper treatment, and are expensive to treat. The physical conditions affecting an oil spill, the type of equipment used, and the extent of the removal operations are contributing factors to the high cost of cleaning up limited oil spills. At the time of the writing of this paper the typical limited oil spill costs the Navy over $1,000 to clean up. This cost will increase as control agencies of Harbor water quality require more complete removal and cleanup. (See also W70-10035) (Ensign-PAI)
W71-05333

UNITED KINGDOM OIL INDUSTRY RESEARCH AND PLANS TO DEAL WITH SEA POLLUTION BY OIL,
Esso Petroleum Co. Ltd., London (England).
H. Jagger.
Prevention and Control of Oil Spills, Joint Conference, Proceedings, New York, New York, December 15-17, 1969, Co-sponsored by American Petroleum Institute and U.S. Federal Water Pollution Control Administration, Washington, D.C. American Petroleum Institute Publication No 4040, p 23-26. 3 ref.

Descriptors: *Pollution abatement, *Oil industry, *Governments, Water pollution control.
Identifiers: Institute of Petroleum, United Kingdom, Inter organization liaison, Tanker industry, International organizations, Oil pollution.

The Institute of Petroleum coordinates the United Kingdom oil companies on the prevention of pollution by oil and provides a link between these oil companies, government departments, the tanker industry and several international organizations. The institute's provisions for the exchange of knowledge and opinions on technical matters of a non-commercial nature relating to the oil industry and its link between government departments and the United Kingdom oil industry on many technical matters from measurement, sampling and testing to the conditions of license for the storage of petroleum spirit are reviewed. The development of the institute's role of oil pollution prevention and the present position of cooperative research and response plans are presented. (See also W70-10035) (Ensign-PAI)
W71-05334

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

MATHEMATICAL MANAGEMENT MODEL--UNCONFINED AQUIFER,
Texas Tech Univ., Lubbock. Water Resources Center; and High Plains Underground Water Conservation District No. 1, Lubbock, Tex.
For primary bibliographic entry see Field 02F.
W71-04931

SIMULATION THEORY APPLIED TO WATER RESOURCES MANAGEMENT,
Nevada Univ., Reno. Center for Water Resources Research.
W. S. Butcher, V. L. Gupta, J. W. Fordham, and R. E. Miller.
Available from NTIS as PB-197 849, $3.00 in paper copy, $0.95 in microfiche. Nevada University Desert Research Institute Technical Report Series H-W, Publication No 7, September 1969. 56 p, 11 fig, 4 tab, 44 ref, 4 append. OWRR Project C-1105 (1582) (1).

Descriptors: *Systems analysis, *Optimization, *Water resources development, Water management (Applied), California, Nevada, Deserts, Arid lands, Irrigation design, Irrigation efficiency, Mathematical models, Simulation analysis, Synthetic hydrology.
Identifiers: Truckee River System (Calif-Nev).

Criteria were developed for management decisions affecting the optimization of complex river system. A NUMBER OF NEWLY—DEVELOPED TOOLS IN THE FIELD OF WATER RESOURCES PLANNING WERE CRITICALLY EVALUATED FOR USE UNDER REALISTIC SITUATIONS. The hydrology of the Truckee River System, Nevada and California, was examined defining the inputs, the hydrologic interactions, and the outputs from the system. Techniques for streamflow data synthesis were examined to determine which of the several methods available was best suited to the multiple-site study. The hydrologic model together with the synthetic flows generated provided a simulation model of the system which was combined with an optimization technique for optimal policy determination. This method of combining the hydrology of the system, streamflow synthesis, and an optimization technique is valid and valuable. (Knapp-USGS)
W71-05042

ANALYSIS OF RESERVOIR YIELD,
Missouri Univ., Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-05081

SYSTEMS ANALYSIS, A SUBSTITUTE FOR PLANNING,
California Univ., Los Angeles.
John A. Dracup.
In: Evaluation Processes in Water Resou Planning, Urbana, Illinois, American W Resources Association, p 26-40, July 1970.

Descriptors: *Systems analysis, Water reso planning, Optimization, Decision-making, C benefit analysis, Uncertainty, Waste water col tion, Economic efficiency.
Identifiers: *Multiple objective planning, So welfare function, Transformation curve, Objec function, Decision theory.

The role of systems analysis in water reso planning is considered. The paper discusses the plication of systems techniques to the measuren of benefits from multiple objective water reso projects. The example of the Great Lakes is g to illustrate the use of systems analysis as a t tilevel-multilayer approach to a complex syst This systems model represents the ecolog physical, biological, processes as well as economic, social, and political aspects of the G Lakes problem. The problem of uncertainty ca incorporated into the analysis through app decision theory. Since this example involves t tipe objective functions, there is no unique solu but a set of efficient solutions exists. Systems an sis provides the decision-maker or planner recommended policies and possible alternat when the dynamics of the system changes. The of systems techniques has been limited with res to waste water collection and treatment sys design. The author concludes that while researc water resource system field is advanced, its im on water resource planning remains limi (Siegenthaler-Rutgers)
W71-05221

PROGRAM BUDGET FOR NATU RESOURCES ACTIVITIES,
Werner Z. Hirach.
In: Program Budgeting, Cambridge, Har University Press, 1967, p 248-282.

Descriptors: *Natural resources developm *Government, *Budgets, Economic evaluat Receation, Decision-making, Time, Costs, Inv ment, Research, Land, Cost-benefit analysis, pollution, Demand, Risk.
Identifiers: *Program budget, *Economic gro Santa Maria project, Alternatives.

The judicious development and managemen natural resources is hampered by the lack of a c fully defined national resources policy. Thus, paper examines some assumptions and object of our natural resources policy and how it eff the economic performance of the country. manner in which natural resources activities treated in the existing scheme is reviewed and s are considered which would bring it closer becoming a program budget. The author presents examples of how program budgeting elucidate allocation decisions. In the conclu section, the administrative and institutional rangements needed to implementation alloca decisions in the natural resources field are sidered. The paper, although concerned with entire field of natural resources uses examples techniques relevant to water resources st (Murphy-Rutgers)
W71-05232

LINEAR PROGRAMMING MODELS WATER POLLUTION CONTROL,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W71-05236

ANALYSIS OF PROJECTS FOR ECONO GROWTH,
Project Development, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-05238

NOTE ON THE APPLICATION OF LINEAR ROGRAMMING TO CAPITAL BUDGETING,
itish Columbia Univ., Vancouver.
ter Lusztig, and Berhard Schwab.
urnal of Financial and Quantitative Analysis, Vol No 5, p 427-431, December 1968.

scriptors: *Linear programming, Discount rate, cision-making.
ntifiers: *Capital budgeting, Objective function, portunity cost, Sensitivity analysis, Internal rate return, Present value.

linear programming model is presented of a ital budgeting decision. Once the discount rate hosen, the present value of the investment pro- t is determined and the linear programming del can be solved. However, the application of ear programming techniques to capital budget- implies a mutual dependence between the op- al solution of the programming model and the count rate used in the calculation of the objec- function coefficients. This problem has been ored in previous research with few exceptions. a solution to this problem, the authors propose a sitivity analysis of the optimal solution with re- d to changes in the coefficients of the objective ction. The present value of the prospective pro- is recomputed and the sensitivity analysis is d to determine whether the optimal solution still alid. This method enables the decision maker to ertain whether the original solution obtained via ar programming is subject to revision. This arti- is relevant for research projects concerned with application of capital budgeting concepts to er resource planning. (Siegenthaler-Rutgers)
1-05244

YSTEMS STUDY OF SOFT GROUND TUN- LING,
ix and Scisson, Inc., Tulsa, Okla; and Little thur D.) Inc., Cambridge, Mass.
primary bibliographic entry see Field 08A.
1-05255

TIMIZATION OF A SINGLE EFFECT LTI-STAGE FLASH DISTILLATION SALINATION SYSTEM,
ois Univ., Urbana. Coordinated Science Lab.
primary bibliographic entry see Field 03A.
1-05256

. Evaluation Process

D RIVERS -- METHODS FOR EVALUA- N,
er Resources Engineers, Inc., Walnut Creek, f.
ael B. Sonnen, Larry C. Davis, William R. on, and Gerald T. Orlob.
lable from NTIS as PB-197 729, $3.00 in r copy, $0.95 in microfiche. Completion Re- October 1970. 106 p, 18 fig, 13 tab, 45 ref. RR Project C-1447 (No 198C) (1).

riptors: *Wild rivers, *Cost-benefit analysis, ngible benefits, *River basin development, odology, Social values, Aesthetics, Monetary fits, Project planning, Optimum development , Recreation, Costs, Washington, *Evaluation. tifiers: *Scale of development, *Nonmonetary fits, *Skagit River basin, Sauk-Suiattle River , Subjective decisions.

methods were developed to include intangi- nonmonetary benefit valuations within tradi- l cost-benefit analyses. Each method was onstrated for the Upper Skagit River Basin (a ntly developed basin) and for the Sauk-Suiat- iver Basin (a currently wild river), two ad- t basins in the State of Washington. The fits Foregone--Subjective Decision Method res (1) estimates of monetary benefits for osed levels of basin development (including ver left wild as one alternative), (2) values for two coefficients in a parabolic equation expressing change of intangible, nonmonetary benefits with increased development, and (3) comparison of total benefits to costs (evaluated independently) to indicate the optimum development level. The Nonmonetary Expression of Benefits Method requires monetary benefits and costs just as in the first method, but nonmonetary benefits are calculated as percentages (up to 1000%) of the identifiable monetary benefits. These percentages are derived from multipliers supplied for each potential water use group or development purpose. The demonstrations for each method indicated that the Sauk-Suiattle River should be left wild, while the Skagit River should be even more fully developed. The research showed that meaningful intangible benefit evaluation is not particularly difficult.
W71-04930

PERCEPTION OF WATER RESOURCE INFORMATION SOURCES AND EDUCATIONAL NEEDS BY LOCAL OFFICIALS AND SPECIAL INTEREST GROUPS,
North Carolina State Univ., Raleigh. Dept. of Adult and Community Coll. Education; and North Carolina Water Resources Research Inst., Raleigh.
James M. Stewart, and David H. Howells.
Available from NTIS as PB-197 730, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute, Report No. 47, January 1971. 27 p, append. OWRR Project A-046-NC (2).

Descriptors: *Social participation, *Decision making, Water pollution, *Local governments, North Carolina, Social aspects, Education.
Identifiers: Public participation, *Public education, Water resources information, *Public information.

The study is a phase of a more comprehensive research effort on communication and educational techniques in water resource management and deals with perception of water resource information sources and educational needs at the local level. Includes chairmen of County Boards of Commissioners, City Managers, Officers of League of Women Voters, Presidents of County Wildlife Clubs, Soil and Water Conservation District Supervisors, County Extension Chairmen, and Executive Committee of Conservation Council of North Carolina. Results show marked deficiencies in public information and education dealing with water resources and will be useful to water resource agencies in assessment and planning of public information and education programs. (HowellsNorth Carolina)
W71-04933

FACTORS INFLUENCING THE RESIDENTIAL UTILIZATION OF RESERVOIR SHORELANDS IN THE SOUTHEAST,
North Carolina Univ., Chapel Hill. Center for Urban and Regional Studies; and North Carolina Water Resources Research Inst., Raleigh.
Raymond J. Burby, III, Thomas G. Donnelly, and Shirley F. Weiss.
Available from NTIS as PB-197 731, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute, Report No 44, December 1970. 50 p, 8 tab, 9 ref, 4 append. OWRR Project B-012-NC (6).

Descriptors: *Reservoirs, Reservoir sites, Reservoir construction, Land development, *Land use, Land ownership, Land management, Watershed management, North Carolina, Water utilization, *Recreation, *Multiple-purpose reservoirs, Recreation facilities, *Social aspects, Local governments.
Identifiers: Land use policy.

For local govermental units to participate effectively in the provision of public recreation facilities at multipurpose reservoir projects, private recreational investment must supplement existing local fiscal resources. Recreational residential development offers one important means of achieving this end, but reservoir shoreline development tends to be unevenly distributed in the Southeast. Before residential investment prospects can be incorporated into water resource project planning, factors influencing variation in reservoir shoreline development should be identified and evaluated wherever possible. Analysis of data from 74 multipurpose reservoir projects in the Southeast indicates that the residential use of water projects is primarily a function of various aspects related to the size of a project, the number and affluence of people living nearby (within 25 miles), and the visual attractiveness of the project. Considering the extent of taxable private shoreline investment as a criterion, local provision of public recreational facilities seems to be feasible for larger reservoirs located within relatively populous and affluent jurisdictions. In the case of smaller reservoirs in low income or rural areas, local government should probably not be expected to provide such facilities, nor, it seems, should local officials expect private recreational investment at multipurpose reservoirs to provide much in the way of fiscal dividends. (Weiss-North Carolina)
W71-04934

ECONOMIC ANALYSIS OF WATER USE IN ILLINOIS AGRICULTURE,
Illinois Univ., Urbana. Dept. of Agricultural Engineering; and Illinois Univ., Urbana. Water Resources Center.
Earl R. Swanson.
Available from NTIS as PB-197 732, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center Research Report No 38, January 1971. 59 p, 19 tab, 8 ref. OWRR Project B-014-Ill (6).

Descriptors: *Irrigation, Linear programming, *Dynamic programming, Crop response, Farm management, *Regression analysis, Soil moisture, *Cost analysis, *Corn (Field), *Evaluation, Illinois, Irrigation efficiency.
Identifiers: Economic analysis.

Approximately 28,000 acres of field and specialty crops were irrigated in Illinois in 1966. Supplemental irrigation of corn accounted for over one half of this acreage. Important elements in the decision to invest in irrigation equipment for corn include the expected effect of irrigation on year-to-year fluctuations in income and on average income. Regression models were used to estimate the influence of moisture variable on corn yield. A moderate gain in expected income from corn was obtained by employing the irrigation policy dictated by dynamic programming rather than the policy from a moisture-deficit model. In addition to the economic analysis of the irrigation of corn viewed as a single crop, it was necessary to examine its role in the context of the total farm business. The competitive position of corn in the rotation was evaluated. Labor distribution was an important factor in determining an optimal cropping pattern. General rules were developed for adjusting leases on rented farms to provide economic incentives for both landlord and tenant to adopt supplemental irrigation. The results of all of the analyses would have been substantially improved with crop-response data from experiments in which the range of variation of water and complentary cultural practices included economically optimal levels of these inputs. (Swanson-Illinois)
W71-04935

WATER SUPPLY MANAGEMENT PLAN FOR MUSKEGON COUNTY,
Muskegon County Metropolitan Planning Commission, Mich.; and Bauer Engineering, Inc., Chicago, Ill.

Available fron NTIS as PB-195 769, $3.00 in paper copy, $0.95 in microfiche. Muskegon County Metropolitan Planning Commission Report, Dec 1969. 101 p. HUD Project No P-295.
Identifiers: *Regional planning, Michigan, *Water supply, Regional planning, Management planning, Groundwater, Surface water runoff, Industries, Re-

sidential buildings, Recreation, Water conservation, Statistical data, Cost estimates, Maps, *Muskegon County, Michigan.

The intent of this report is to provide a framework for a coordinated, guided, and planned management of water supply systems in Muskegon County. As a basis for this framework, an inventory of present water quality, quantity, location, and usage is provided. All sources of water, groundwater, inland surface water, and Lake Michigan water, are considered. Residential, commercial, and industrial water usage are discussed. Public attitudes toward water supply have been surveyed and are reported. A management strategy (a process-oriented version of a plan) is proposed. Here major issues in water supply management; namely: (1) the formulation of a coordinating body; (2) the expansion of public supply service areas; (3) water for recreation; and (4) water conservation are discussed in reference to the development of a country-wide approach to water supply.
W71-04945

RECREATION AND THE LOCAL ECONOMY - AN INPUT-OUTPUT MODEL OF A RECREATION-ORIENTED ECONOMY,
Wisconsin Univ., Madison. Graduate School of Business Administration.
William A. Strang.
Available from NTIS as PB-195 744, $3.00 in paper copy, $0.95 in microfiche. Sea Grant Technical Report No 4, WIS-SG-71-204, Oct 1970. 68 p, 2 fig, 14 tab, 52 ref. NSF Grant GH-102.
Identifiers: *Economic development, *Wisconsin, *Recreational facilities, *Lakes, Regional planning, Industrial management, Water quality, Mathematical models, Cash flow, Water resources, Statistical data, Sea Grant program, Recreation oriented economics, Green Bay (Wisconsin), Door County (Wisconsin), Tourism, Input output models.

The scope was broadened of a marine research program conducted in Green Bay, a major bay of Lake Michigan. The findings are presented of the first stage of a 3-stage project to relate water quality to the economic health of an area oriented toward outdoor recreation. The 3 project stages are: (1) Identify the economic interactions in the area and trace the total impact of tourism on the economy; (2) measure the direct and indirect economic impacts of specific groups of tourists on the local economy; and (3) relate the several dimensions of the quality of local water resources to the number of tourists drawn to the area in these specific groups. It will then be possible to relate water quality to an important segment of the local economy.
W71-04955

CONSERVATION, CONTROL, AND USE OF WATER RESOURCES OF THE MISSOURI RIVER BASIN.
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04986

A SUMMARY OF MASSACHUSETTS STATE LAWS, POLICIES AND PROGRAMS PERTAINING TO WATER AND RELATED LAND RESOURCES.
Massachusetts Water Resources Commission, Boston. Div. of Water Resources.
For primary bibliographic entry see Field 06E.
W71-04996

WATER RESOURCES PLANNING SEMINAR,
Florida State Board of Conservation, Tallahassee. Div. of Water Resources and Conservation.
Charles Appel, George T. Baragona, Woody Beeman, E. W. Bishop, and Mickey D. Bryant.
March 1968. 161 p, 1 fig, 5 chart, 1 append.

Descriptors: *Florida, *Water resources development, *Planning, *Training, Administration, Administrative agencies, Water resources, Natural resources, Conservation, River basin development, Water law, Legal aspects, Water policy, Watershed management, Hydrological aspects, Water pollution control, Geologic investigations, Economic justification, Water demand, Water supply, Surface waters, Public health, Recreation demand, Personnel, Leadership.

To provide staff personnel with a basic, overall view of the technical, administrative, and legal problems and terminology of water resources study and planning, the Florida Board of Conservation, Division of Water Resources and Conservation sponsored a training seminar in water resource planning. This report summarizes the six sessions of the seminar and makes recommendations concerning future seminars. An appendix consists of the texts of individual speakers' presentations on: (1) geography, (2) water resources, (3) lake hydrology, (4) surface water hydrology, (5) chemical quality of water in Florida, (6) history of river basin planning, (7) geology and water resources planning, (8) U.S. Department of Agriculture agency roles in river basin planning, (9) economic development and projections in river basin planning, (10) U.S. Forest Service responsibilities in river basin planning, (11) economic planning by soil conservation service in river basin planning, (12) hydraulic engineering, (13) geology of Florida, (14) physiography of Florida, (15) sink holes, (16) water resources problems, (17) municipal water use, (18) industrial use, (19) water resources project evaluation for fish and wildlife resources, (20) water law in Florida, (21) air and water pollution control commission, (22) State Board of Health activities, and (23) planning for public resources based on outdoor recreation. (Liptak-Florida)
W71-04997

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 2, SECTION B-HYDROLOGY,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05037

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 4, SECTION E - COST FUNCTIONS FOR INFLUENCING WATER QUALITY; SECTION F - RELATION OF PARTICIPATION IN OUTDOOR RECREATION AND PUBLIC ATTITUDES TOWARD WATER QUALITY,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05038

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 5, SECTION G - SYSTEMS ANALYSIS OF HYDROPOWER PRODUCTION ON THE WISCONSIN RIVER,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05039

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 9, SECTION K - AN ANALYSIS OF ALTERNATIVE INSTITUTIONAL PATTERNS FOR MANGING WATER QUALITY ON A REGIONAL SYSTEM BASIS,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05041

FIFTEENTH ANNUAL WATER CONFEREN
New Mexico State Univ., University Park. W Resources Research Inst.
For primary bibliographic entry see Field 04B.
W71-05065

PUBLIC OPPOSITION TO NUCLEAR POW AN INDUSTRY OVERVIEW,
Atomic Industrial Forum, Inc., New York; Niagra Mohawk Power Corp., Syracuse, N.Y.
For primary bibliographic entry see Field 05C.
W71-05126

ENGINEERING SAFETY FACTORS THEIR INFLUENCE ON SITING PRACTI FOR NUCLEAR POWER PLANTS IN THE ROPEAN COMMUNITIES,
Council of the European Communities, Bru (Belgium). Industrial Affairs.
For primary bibliographic entry see Field 05C.
W71-05129

SOIL AND WATER CONSERVATION NE INVENTORY, COOKE, GRAYSON AND F NIN COUNTIES, TEXAS.
Texoma Regional Planning Commission, Tex.
For primary bibliographic entry see Field 03F.
W71-05150

WATER RESOURCES COUNCIL; POLIC AND PROCEDURES IN PLAN FORMULAT AND EVALUATION OF WATER AND LATED LAND RESOURCES PROJECTS.
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 06C.
W71-05187

WATER PROJECTS -- A CHANGING PERSE TIVE,
Sierra Club, San Francisco, Calif.
Michael McCloskey.
Sierra Club Bulletin, Vol 55, No 7, p 8-11, 1970.

Descriptors: *Project feasibility, *Economic ju cation, *Evaluation, *Water resources deve ment, *Federal project policy, Water manager (Applied), Political aspects, Water policy, Fed government, Water Quality Act, History, S aspects, Social needs, Water conservation, Leg tion, California, Arizona, Arkansas, Projects, River Act, Benefits, Hydroelectric power.
Identifiers: *Central Arizona Project.

Most of the politically and economically desir water projects have been built largely in western U.S. In earlier periods, public policy benefit of the doubt to the case for constructio water projects. However, conditions which once have justified this approach have char radically. Nevertheless, that past great perio water project development has generated pow federal agencies having vested interests in cont ing these activities, even though diminis returns may be accruing in terms of total pu values stemming from further projects. Cur goals of the Federal Power Commission, Corp Engineers and Bureau of Reclamation are revie and discussed. It is argued that tradition and terests of special clienteles are too often dicta irrelevant, or uneconomic projects and the us obsolete methods. An example is the Cen Arizona Project, which will create an artifi agricultural demand which would not exist in absence of a heavy water cost subsidy. There a basic aspects of water project evaluation: engin ing, economics and intangibles. Enginee aspects could be handled by the construction ag cy but the other 2 aspects should be handled separate evaluating agencies. Congressi evaluation and legislation of agency proposal also in great need of modernization. (Case Arizona)
W71-05195

VATER QUALITY, THE STATE OF THE ART,
Vayne State Univ., Detroit, Mich.
or primary bibliographic entry see Field 05G.
V71-05212

OFT WATER SUPPLY FOR URBAN CONUMPTION, A FEASIBILITY STUDY,
/ater Planning for Israel Ltd., Tel-Aviv.
or primary bibliographic entry see Field 04B.
/71-05215

/ATER RESOURCE MANAGEMENT IN ARID NVIRONS,
esources for the Future, Washington, D.C.; and wa State Univ., Ames.
or primary bibliographic entry see Field 04B.
71-05216

/STEMS ANALYSIS, A SUBSTITUTE FOR LANNING,
alifornia Univ., Los Angeles.
r primary bibliographic entry see Field 06A.
71-05221

ULTIPLE OBJECTIVE PLANNING, BENEFIT-OST ANALYSIS AND DISCOUNT RATE,
ater Resources Council, Washington, D.C.
ry D. Cobb.
Evaluation Processes in Water Resources nning, Urbana, Illinois, American Water sources Association, p 101-118, July 1970.

scriptors: *Cost benefit analysis, Discount rate, onomic evaluation, Decision-making, Interest e, Economic efficiency.
ntifiers: *Multiple objective planning, Regional velopment, Social rate of discount, Transformaon curve, Public investment, Opportunity cost, adow price.

e work of the special taskforce of the Water sources Council on evaluation practices used in deral water resource projects is reviewed. nefits and costs are defined in terms of the objecves of national income growth, social well-being, ional development and enhancement of enonmental quality. The planning process for use water resources includes the formulation of alnatives in order that tradeoffs among plans can identified. The approach selected is multiobjecwith the aim of the project design to choose the nt of highest social value or, if using weights, the nest cost-benefit ratio. Problems connected with t-benefit analysis are discussed including inst rate standards, secondary benefits, pricing blems and weighting. The author concludes that ajor impediment is the divergent views on the ning of cost-benefit analysis among planners. author recommends that planners should ount both public and private projects at the so- rate of discount for benefit-cost calculations. genthaler-Rutgers)
1-05224

CIAL PROBLEMS OF METROPOLITAN TER RESOURCES ANALYSIS,
cago Univ., Ill.
n R. Sheaffer.
Evaluation Processes in Water Resources ning, Urbana, Illinois, American Water ources Association, p 75-90, July 1970.

criptors: *Water resources management, *Mul-purpose projects, Water quality, Cost-benefit ysis, Decision-making, Waste water treatment, ulation analysis, Political constraints.
tifiers: *Metropolitan planning, Complex agement strategy, Iterative process.

ropolitan water resource management is conred to be a subsystem of the total urban system. author identifies a number of concepts of ropolitan water resource management includmultiple purpose planning, public and private sion-making on water resources projects and political constraints on policy making. The example of Waterloo, Iowa is used to demonstrate the weakness of single purpose strategies for water resource planning. The complex management strategy is introduced as an alternative approach with the use of water as an organizing concept. The organizing concept discourages single-purpose strategies and provides a means for channeling the information required for an optimal solution. The Muskegon County waste water management plan is used to present methodology for the implementation of new technology in a metropolitan area. This plan recognized the need for broad unified goals and facilities plus community involvement and education. A model of waste water irrigation is also presented to illustrate the use of computer simulation in the complex management strategy. Stress is given to the need for research concerning the adaptation of models and planning processes to the metropolitan region. (Siegenthaler-Rutger)
W71-05225

POLITICAL AND INSTITUTIONAL ASPECTS OF THE EVALUATION OF WATER RESOURCES PROGRAMS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-05226

THE DEFINITION AND MEASUREMENT OF DROUGHT LOSSES: THE NORTHEAST DROUGHT OF 1962-1966,
Resources for the Future, Washington, D.C.
For primary bibliographic entry see Field 06C.
W71-05233

ANALYSIS OF PROJECTS FOR ECONOMIC GROWTH,
Project Development, Inc., Washington, D.C.
Morris J. Solomon.
New York, Praeger, 1970. 498 p.

Descriptors: *Decision-making, Benefit-cost analysis, Economic evaluation, Discount rate.
Identifiers: *Project analysis, Economic growth, Payback period, Opportunity cost, Sensitivity analysis, Present value, Time horizon.

A framework is presented for project analysis that can be used to evaluate alternative projects in addition to the primary project. The framework specifies the data required, the format to be used, and the criteria to apply to the evaluation of alternatives. The process of decision-making is described in terms of a planning-action feedback cycle. The fundamentals of time phasing and discounting are described with their use as tools for project evaluation outlined. Economic yardsticks such as national gross rate of return and surplus rate of return are proposed to serve as indicators of the attractiveness of a project from an economic growth point of view as well as the impact on particular groups in the economy. The problems of interdependence among projects and uncertainty are discussed with procedures for dealing with each problem illustrated. This book is relevant for water administrators concerned with the formulation, evaluation, and implementation of water resource projects. (Siegenthaler-Rutgers)
W71-05238

REVELATION OF PREFERENCE FOR A PUBLIC GOOD WITH IMPERFECT EXCLUSION,
Northwestern Univ., Evanston, Ill.
Morton I. Kamien, and Nancy L. Schwartz.
Public Choice, Vol IX, p 19-30, Fall, 1970.

Descriptors: *Economic evaluation, *Government, *Resource allocation, Economic efficiency, Model study, Prices, Optimization, Social aspects, Probability, Maximization, Demand.
Identifiers: *Public goods, *Utility, *Preference function, *Exclusion, *User charges.

The model presented is designed to explain the behavior of an individual in revealing his preferences regarding goods which do not permit perfect exclusion. This is particularly relevant to the case of water resources recreation in which the authors' explanation of user charges is most applicable. It is shown that a bid of zero will be made if the public good does not increase his total utility at a zero price or if the probability of being able to consume the good without payment is sufficiently large. The paper derives the difference between the maximum the individual would be willing to pay rather than do without and the optimal amount he would bid in the presence of imperfect exclusion. The individual almost always understates some of his preference for the good but it is shown that the individual's offer increases, and hence moves in the direction of his true preference, as the degree of exclusion increases. This article is relevant for establishing cost justifications with respect to many of the environmental amentities associated with water investment projects. (Murphy-Rutgers)
W71-05239

CHOICE OF TECHNIQUE IN THE PUBLIC SECTOR: A SIMPLIFICATION,
Harvard Univ., Cambridge, Mass.
Martin S. Feldstein.
The Economic Journal, Vol LXXX, No 320, p 985-989, December 1970.

Descriptors: *Benefits, *Costs, *Discount rate, *Economic evaluation, *Government, Time, Capital, Investment, Social aspects, Economic efficiency, Optimization, Taxes, Mathematical study.
Identifiers: *Social time preference, *Social rate of return, *Opportunity costs.

The aggregation of the benefits and costs of public water resource investments raises the problem of incorporating both the normative social time preference discount rate and the social rate of return on private investment. This paper attempts to show that in an important special class of public-expenditure decisions the problem of evaluating the social opportunity cost of funds transferred from the private sector can be ignored and only the social time preference rate is important. Thus, the paper is relevant for the evaluation of water resource investments. The author also argues against the suggestion that all public expenditure proposals be evaluated only at the social time preference rate with no regard for the social opportunity costs of the funds transferred from the private sector. (Murphy-Rutgers)
W71-05240

THE EVALUATION OF RISKY INTERRELATED INVESTMENTS,
Stanford Univ., Calif.
For primary bibliographic entry see Field 06C.
W71-05241

THE INDUSTRIAL POINT OF VIEW,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 05G.
W71-05242

WATER QUALITY AND MAN'S ENVIRONMENT,
Federal Water Pollution Control Administration, Kansas City, Mo.
For primary bibliographic entry see Field 05G.
W71-05243

SOCIAL SCIENCES AND THE ENVIRONMENT,
Colorado Univ., Boulder, and Environmental Science Services Administration, Washington, D.C.
Morris E. Garnsey, and James R. Hibbs.
Boulder, University of Colorado Press, 1967. 249 p.

Descriptors: *Environment, Cost-benefit analysis, Program budgeting, Decision making, Economic evaluation.
Identifiers: *Public good, Social benefit, Social cost.

The papers were presented at the Conference on the Present and Potential Contribution of the Social Sciences to Research and Policy Formulation in the Quality of the Physical Environment in 1967. They were cross-disciplinary and are illustrations of contributions of several disciplines to research in the quality of the physical environment. The subjects considered included ecology, program budgeting, public goods valuation and a multidisciplinary attack on water pollution. The use of cost-benefit analysis in public decision-making was discussed along with the empirical problems of calculations. The treatment of such topics as public goods, cost benefit analysis and water pollution problems makes this bookof general relevance to water studies. (See also W71-05246) (Siegenthaler-Rutgers)
W71-05245

ECONOMICS AND THE QUALITY OF THE ENVIRONMENT, SOME EMPIRICAL EXPERIENCES,
Resources for the Future, Washington, D.C.
Allen V. Kneese.
In: Social Sciences and the Environment, Boulder, University of Colorado Press, 1967, p 165-182.

Descriptors: *Cost-benefit analysis, Probability, Economic evaluation, Resource allocation, Mathematical model, Flood control.
Identifiers: *Willingness to pay, Public good, Externalities, Social benefit.

Experiences and problems of estimating the benefits of environmental improvement are discussed. With respect to benefit evaluation, the economists' conceptual framework uses prices as indicators of social value or benefits. Where market failure occurs, certain market prices together with assumptions about human preferences and behavior care are used in the valuation process. An example of this imputation procedure is the determination of flood control benefits where the measurement of the benefit can be taken as the avoidance of the loss. The author discusses the willingness to pay for improved water quality from the point of view of municipal and industrial users and recreational use. Research indicates that the benefits of improved water quality to municipal and industrial users do not justify the incremental costs. With respect to recreational use, the total value attached to recreational resources is a function of the number of people who have access and the availability of alternatives. The author stresses the need for further research on the benefits of water improvement for recreational demand. (See also W71-05245) (Siegenthaler-Rutgers)
W71-05246

PLANNING-PROGRAMMING-BUDGETING: A SYSTEMS APPROACH TO MANAGEMENT,
Washington Univ., Seattle.
Fremont J. Lyden, and Ernest J. Miller.
Chicago, Markham Publishing Company, 1967. 443 p.

Descriptors: *Systems analysis, Economic evaluation, Cost-benefit analysis, Decision-making, Economic efficiency, Risk, Program budgeting.
Identifiers: *Planning-Programming, Budgeting, Cost utility analysis.

This book presents a collection of readings that provide an understanding of Planning-Programming-Budgeting (PPB) and its implications in managerial as well as policy contexts. PPB places emphasis upon program results and analytical techniques and thus affects public management. The essays consider what the PPB approach to management is, its stages of development, the relationship of PPB to other kinds of budgeting approaches, and its limitations and deficiencies. This book is relevant to water studies concerned with the application of new budgeting approaches to program evaluation and project selection. (See also W71-05248) (Siegenthaler-Rutgers)
W71-05247

TOWARD A THEORY OF BUDGETING,
International Atomic Energy Commission, New York.
Verne B. Lewis.
In: Planning-Programming-Budgeting: A Systems Approach to Management, Chicago, Markham Publishing, 1967, p 117-139.

Descriptors: *Budget estimation, Marginal utility, Incremental analysis, Economic evaluation, Cost-benefit analysis, Forecasting.
Identifiers: *Public expenditure budgeting, Alternative budgeting, Open-end budgeting, Unit costing, Fixed-ceiling method, Opportunity cost.

Analyzes were made of propositions derived from economic theory which are applicable to public budgeting and can serve as the basis for an economic theory of budgeting. The economic aim of budgeting is to achieve the efficient use of resources. To meet this aim, the benefits derived from any expenditure must be worth their cost in terms of sacrificed or displaced alternatives. Incremental analysis at the margin is applied to concentrate attention on resources which yield the higher return. These values can be compared by determining their relative effectiveness in achieving a common purpose. The author suggests the alternative budget procedures as a method of budget analysis. Its purpose is to pose budget questions in terms of relative value at every level of decision making. Under alternative budgeting, officials would present both a basic budget estimate and plans for alternative amounts near the margin. A comparison of alternative budgeting is made with existing budgeting techniques. This article is relevant for water research concerned with the budgeting control of water resource programs. (See also W71-05247) (Siegenthaler-Rutgers)
W71-05248

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST OF PUMPING IRRIGATION WATER IN ARIZONA: 1891 TO 1967,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-04851

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 4, SECTION E - COST FUNCTIONS FOR INFLUENCING WATER QUALITY; SECTION F - RELATION OF PARTICIPATION IN OUTDOOR RECREATION AND PUBLIC ATTITUDES TOWARD WATER QUALITY,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05038

WATER RESOURCES COUNCIL; POLICIES AND PROCEDURES IN PLAN FORMULATION AND EVALUATION OF WATER AND RELATED LAND RESOURCES PROJECTS.
Water Resources Council, Washington, D.C.

Federal Register, Vol 35, No 143, Friday, July 24, 1970, p 11969-11970.

Descriptors: *Discount rate, *Cost-benefit analysis, *Federal-project policy, *Interest rate, Water resources, Administration, Decision making, Water resources development, Federal government, Cost analysis, Cost allocation, Cost repayn Economics, Appraisals, Project planning, trends, Variable costs, Administrative age Financial analysis, Regulation, Resource dev ment, Economic efficiency, Economic justifica Economic prediction, Institutional constraints
Identifiers: *Water Resources Council.

Provided in this administrative regulation is n of a 5 1/8% interest rate to be applied by all fe agencies in the formulation and evaluation of and related land resource plans. The new rat forth by the Water Resources Council, is effe July 1, 1970 through June 30, 1971. This rate be applied in discounting future benefits and puting costs in all federal and federally ass water-resource projects. (Earl-Florida)
W71-05187

TERMINAL VALUE OR PRESENT VALU CAPITAL BUDGETING PROGRAMS,
Michigan Univ., Ann Arbor.
William H. Jean.
Journal of Financial and Quantitative Analysis VI, No 1, p 649-651, January 1971.

Descriptors: *Linear programming, Marginal Constraints, Interest rate.
Identifiers: *Capital budgeting, Terminal v Present value, Sensitivity analysis, Objective tion, Cashflow, Shadow price.

A model is presented to deal with a linear gramming capital budgeting problem where pr selection is based on the criterion of present v The basic constraints of the linear program model are defined and modified to allow for in ment of excess cash inflows and borrowing. W the separate borrowing and lending rates are e maximization of the terminal value of the obje function will also maximize the present value o projects. Thus, the present value model is a sp case of the terminal value model. Imputed int rates can be derived as well as the marginal rat returns on capital budgets. This article relevance to water research concerned with pr budgeting and evaluation. (Siegenthaler-Rutge
W71-05222

MULTIPLE OBJECTIVE PLANNING, BENE COST ANALYSIS AND DISCOUNT RATE,
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-05224

PROGRAM BUDGETING,
RAND Corp., Santa Monica, Calif.
David Novick.
Cambridge, Harvard U. Press, 1967. 382 p.

Descriptors: *Budgets, *Government, *Decis making, Cost-benefit analysis, Natural reso development, Risk, Economic evaluation, W resources, Transportation, Recreation, R an Economic efficiency, Costs, Resource allocatio
Identifiers: *Program budgeting, *Cost utility a ysis, Health, Education, Department of Defens

This study is concerned with program budgetin it relates to the decision-making process and problems of data and analysis. The book opens a discussion of the government decision-ma process and the role of budgeting. Of particula terest to the water researcher is the considera of cost-utility analysis and other analy techniques. The development of program bud ing in the Department of Defense is described examples are given of ways in which this con might be adapted to other government activi including that of natural resources. The last sec of the book deals with implementation and op tion of the program budget and considers som the potential problems and limitations. There discussion of the application of an opera federal program budget in terms of its usefulnes the executive branch, the legislative branch,

ates and private economists and political ientists. (Murphy,Rutgers)
'71-05229

MITATIONS, RISKS AND PROBLEMS,
rginia Univ., Charlottesville; and Columbia iiv., New York.
oland N. McKean, and Melvin Anshen.
Program Budgeting, Cambridge, Harvard iiversity Press, 1967, p 285-307.

escriptors: *Budgets, *Government, *Risk, Deci-n-making, Management, Social aspects, Costs, nimization, Resource allocation, Economic effi-ncy, Planning, Technology, Optimization.
ntifiers: *Program budgeting, Cost-utility analy-, Bureaucracy, Central control, Relevant alterna-es, Institutional problems.

tempts are made to analyze the problems, limita-ns and risks of a program budget. The use of the ogram budget in water resources, along with the ter resource example presented by the authors ke this article relevant to the water researcher. fficulties in the program budget are described as nceptual, operational and institutional. The con-otual difficulties are those encountered in desig-g the program budget and relating it to the deci-n-making requirements of the government. erational difficulties are related to managerial plementation of the program budget. Institu-nal difficulties are described as those en-raged by bureaucratic or political pressures. e description and assessment of problems, itations and risks is followed by suggestions for ing with them and minimizing their impact and nificance. (Murphy-Rutgers)
1-05230

NCEPTUAL FRAMEWORK FOR THE PRO-AM BUDGET,
rvard Univ., Cambridge, Mass.
hur Smithies.
Program Budgeting, Cambridge, Harvard versity Press, 1967, p 24-60.

criptors: *Budgets, *Economic evaluation, overnment, Costs, Planning, Decision-making, nomic efficiency, Forecasting, Time, Prices, ional analysis, Investment, Measurement, So-aspects.
ntifiers: *Programming, *Policy objectives, levant alternatives, Economic scarcity.

nning, programming and budgeting constitute process by which objectives and resources, and interrelations among them, are taken into ac-nt to achieve a coherent and comprehensive gram of action for the government. This paper mpts to develop a framework in which this ess may be carried out. A survey of the history udgetary methods is provided and the criteria he designation of an operation as a program is ussed. The functions of programming and geting are delineated and their respective pur-s explained. The analysis of a program seeks to rmine the effectiveness in achieving an objec-and the economic efficiency with which the ram is carried out. The role of economic analy-important but cannot provide all the necessary rmation. The author proposes that programs be ewed annually in a specific manner and makes mber of suggestions to improve the budgeting ess. In the concluding section the paper points he necessary staff arrangements for an effec-programming-budget system. The paper pro-insights into the development of more effec-program budgeting in water resources develop-t and thus is relevant to the interests of the r researcher. (Murphy-Rutgers)
-05231

DEFINITION AND MEASUREMENT OF UGHT LOSSES: THE NORTHEAST UGHT OF 1962-1966,
urces for the Future, Washington, D.C.
ord S. Russell.
In: Proceedings of the Fourth American Water Resources Conference, New York, NY, November 18-22, 1968, p 623-635.

Descriptors: *Decision making, *Drought, Cost-benefit analysis, Cooling tower, Recirculated water, Economic evaluation, Discount rate.
Identifiers: *Social cost, Opportunity cost, Public investment.

A study was made of drought losses based on field work in three Massachusetts cities. Interviews were conducted with managers of industrial firms and commercial establishments in order to make an initial estimate of drought losses. The raw annual drought losses tended to be dominated by the industrial and municipal government sectors. The bulk of losses were business investment in wells, cooling towers, lost municipal revenues, and the costs of emergency water supplies. Corrections were made for the investment aspect of losses with an aggregate profit resulting from drought induced investment. Further corrections were performed for the transferral or deferral of production and unemployment. It was found per capita losses increase with the size of the water shortage with the rate of increase being smaller for the corrected estimates. This example of loss estimation is useful for the planning of water supplies in the future. (Siegenthaler-Rutgers)
W71-05233

THE EVALUATION OF RISKY INTERRELATED INVESTMENTS,
Stanford Univ., Calif.
Frederick S. Hillier.
Amsterdam, North-Holland Publishing Company, 1969. 113 p.

Descriptors: *Economic evaluation, *Risk, Linear programming, Probability distribution, Decision-making, Budget constraint.
Identifiers: *Interrelated investment, *Chance-constrained programming, Present value, Expected utility, Cash flow, Algorithm, Non-parametric statistics.

The problem of evaluating a proposed set of risky interrelated investments is studied, using present value and expected utility of present value as criteria. The author developed properties that characterize and optimal combination of investments and then formulated a model for describing interrelated investments. This model can be used for determining the mean, variance and functional form of the probability distribution of present value. An approximate linear programming and an exact branch-and-bound algorithm were developed for selecting the investment to be made. The problem was studied also from a dynamic point of view using chance-constrained programming models for maximizing present value subject to probabilistic constraints on the allowable risk. The advantage of the expected utility approach lies in its precise evaluation of investments while the chance-constrained programming approach is dynamic and easier to implement. This book is relevant to water resource studies concerned with the application of evaluation techniques to problems of capital budgeting and investment planning. (Siegenthaler-Rutgers)
W71-05241

A NOTE ON THE APPLICATION OF LINEAR PROGRAMMING TO CAPITAL BUDGETING,
British Columbia Univ., Vancouver.
For primary bibliographic entry see Field 06A.
W71-05244

TOWARD A THEORY OF BUDGETING,
International Atomic Energy Commission, New York.
For primary bibliographic entry see Field 06B.
W71-05248

6D. Water Demand

CONSUMPTIVE IRRIGATION REQUIREMENTS FOR CROPS IN IDAHO,
Idaho Univ., Moscow. Dept. of Agricultural Engineering; and Idaho Water Resource Board.
For primary bibliographic entry see Field 03F.
W71-05201

6E. Water Law and Institutions

EDWARD BALF CO V HARTFORD ELECTRIC CO (REMEDIES FOR OBSTRUCTION OF NAVIGABLE RIVER).

138 A 122-127 (Conn 1927).

Descriptors: *Connecticut, *Navigable waters, *Navigation, *Remedies, Damages, Conduits, Construction, Riparian land, Riparian rights, Channels, Dredging, Bridges, Federal government, Banks, Water levels, Navigable rivers, Administrative agencies, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff roadbuilding company sought an injunction to restrain defendant electric company from maintaining a conduit over a river, thereby obstructing navigation and preventing plaintiff from transporting materials by boat to its land. Defendant contended that the river was not navigable and that therefore such an action could not be maintained. The trial court found: (1) that the river was navigable, (2) that defendant's conduit obstructed navigation, but (3) that the conduit constituted a public nuisance and plaintiff did not show an injury distinct from others. Both parties appealed and the Connecticut Supreme Court of Errors affirmed. Evidence showed that the stream was navigable. The federal government exercised jurisdiction over it as a navigable stream. A river is navigable when it is used or is susceptible of use in its natural and ordinary condition as a highway for commerce. The fact that this river had not been used recently by boats and would need some dredging did not render it non-navigable. Plaintiff's evidence did not show substantial, serious, or actual damage. The fact that plaintiff was deprived of access to its land by water was not conclusive of a special injury to its business. (Duss-Florida)
W71-04961

FEDERAL PROTECTION OF ENDANGERED WILDLIFE SPECIES,
William S. Boyd.
Stanford Law Review, Vol 22, No 6, p 1289-1309, June 1970. 21 p, 138 ref.

Descriptors: *Wildlife, *Wildlife conservation, *Wildlife management, *Federal government, State governments, Legislation, Legal aspects, Judicial decisions, Administration, Environment, Ecology, Environmental effects, Regulation, Standards, Hunting, Fishing, Animal behavior, Migratory birds, Waterfowl, Fish, Conservation, Nesting, Breeding, Federal jurisdiction, State jurisdiction, United States.

Advocating increased federal protection of endangered wildlife species, this note considers the constitutional aspects of the issue and suggests possible directions for federal regulation. Traditionally states have exercised primary responsibility for wildlife protection; however, state efforts have been largely ineffective. Heretofore, the federal government's contribution in the area has been minimal. Opponents of federal legislation have argued that: (1) the issue was decided against the government in the Supreme Court decision of Missouri v. Holland; (2) there is no enumerated provision in the Constitution permitting the government to enact such legislation; and (3) the states are sole owners of wildlife within their borders, and such ownership

precludes federal interference. This note argues that: (1) Missouri v. Holland did not preclude federal legislation for wildlife protection, (2) the territorial power or commerce clause in the Constitution could serve as a basis for legislation, and (3) the doctrine of state ownership of wildlife has been ineffective where it has conflicted with federal interests. Exclusive federal control over wildlife is not needed, but legislation should empower appropriate federal departments to promulgate necessary regulations and encourage states to adopt effective programs for wildlife protection. At any rate, exclusive jurisdiction should not be left to the states. (Duss-Florida)
W71-04982

OIL POLLUTION DAMAGE TO NAVIGABLE WATERS AND MARINE LIFE GIVES RISE TO MARITIME LIEN WHICH WILL SUPPORT ADMIRALTY ACTION IN REM.
Journal of Maritime Law and Commerce, Vol 2, No 1, p 200-202, Oct 1970. 3 p, 9 ref.

Descriptors: *Federal jurisdiction, *Admiralty, *Ships, *Water pollution control, Pollution abatement, Pollutants, Water pollution sources, Water pollution effects, Federal government, State governments, Public benefits, Navigable waters, Sea water, Marine animals, Marine plants, Public rights, Damages, Impaired water quality, Administrative agencies, Environmental effects, Cost repayment, Legal aspects, Judicial decisions, Legislation, California.
Identifiers: Oil pollution.

This comment summarizes Department of Fish and Game v. Bournemouth, 307 F. Supp. 922 (C.D. Cal 1969), a decision of a United States district court holding defendant ship amenable to a maritime lien supporting an in rem admiralty action for the costs of abatement and damages arising from oil pollution of navigable waters of plaintiff state of California. The court held that the Admiralty Extension Act of 1964 did not give rise to a lien against the defendant. However, the court determined that under principles of general maritime law, it had jurisdiction to impose a lien against the defendant. Noting that the injury in question was to the water itself and that maritime liens generally arise from collisions or personal injuries, the court held that efforts to distinguish between various types of property would be useless. The court noted that, in light of the growing incidence of oil pollution of navigable waters by ships, the public interest is best protected by the imposition of maritime liens against the offending vessel. (Earl-Florida)
W71-04983

THE ECUADOR FISHERIES DISPUTE (A NEW APPROACH TO AN OLD PROBLEM),
Daniel C. Lecuona.
Journal of Maritime Law and Commerce, Vol 2, No 1, p 91-114, Oct 1970. 24 p, 137 ref.

Descriptors: *International law, *Marine fisheries, *Law of the sea, *International waters, Commercial fishing, International commissions, Treaties, United Nations, United States, Oceans, Beds, Fishing, Conservation, Legal aspects, Fisheries.
Identifiers: *Ecuador, *Territorial sea.

Discussing the dispute over fishing rights in the Pacific Ocean off the coast of Ecuador, this article first discusses the historical basis for nations' claims to territorial waters, controversies that have arisen, and trends toward expansion of the territorial limit. It is the general consensus that a nation has exclusive fishing rights in what is determined to be its territorial sea and in the sea bed and sub-soil under the territorial sea. Ecuador claims sovereignty to a distance of 200 miles, while the United States recognizes a 12-mile limit. In considering the positions of Ecuador and the United States, the author concludes that Ecuador's position is not in opposition to historically recognized legal principles. The problem is that it is in the interests of smaller nations to claim a large territorial sea while it is in the interests of larger nations to assert a narrow one. Factors influencing such preferences include the relative sizes of national fishing fleets and the availability of fish in various areas. The author notes that Ecuador has been willing to negotiate fishing rights and concludes that there will be accommodation in this area when larger nations recognize the legitimate interests of smaller nations. (Duss-Florida)
W71-04984

ATTORNEY GENERAL'S OPINION ON CONFLICT BETWEEN FLORIDA AIR AND WATER POLLUTION CONTROL ACT AND OIL SPILL PREVENTION AND POLLUTION CONTROL ACT.
Florida State Dept. of Legal Affairs, Tallahassee.

1970 Florida Attorney General Opinions, No 070-121, Sept 2, 1970. 6 p.

Descriptors: *Florida, *Legislation, *Pollution abatement, *Administrative agencies, State governments, Administrative decisions, Water pollution, Water pollution control, Pollutants, Public health, Air pollution, Oil, Oily water, Legal aspects.

This opinion of the Florida Attorney General answers the following questions: (1) does the Oil Spill and Pollution Control Act (Chapter 70-244) conflict with the Air and Water Pollution Control Act (Chapter 403); (2) if this legislation conflicts, which agency has responsibility for conflicts in the area; (3) does Chapter 70-244 conflict with the 1969 Governmental Reorganization Act. Responding to question 1, it was observed that where there is comprehensive legislation like Chapter 403, and a later act applies only to a particular aspect of the same subject, the statute relating to a particular part operates as an exception to the general law. The Attorney General concluded that there was no conflict. The Attorney General noted that the agencies should cooperate in favor of the public interest, but that if a conflict arose the later act would prevail. Since a response to question 3 would involve passing on a matter of legislative discretion, the Attorney General declined to answer it. He stated that the Department of Air and Water Pollution Control is the actual pollution control agency of Florida, subject to the exceptions in Chapter 70-244 relating to oil and other pollutants spilled in the coastal areas subject to control of the Department of Natural Resources. (Hart-Florida)
W71-04985

CONSERVATION, CONTROL, AND USE OF WATER RESOURCES OF THE MISSOURI RIVER BASIN.
Department of the Interior, Washington, D.C.

US Senate Document 191, 78th Cong, 2d Sess, April 1944. 211 p, 24 map, 137 tab, 16 chart, 5 append.

Descriptors: *Reclamation, *Multiple-purpose projects, *Water resources development, *River basin development, Watersheds (Basins), Regional analysis, Water conservation, Water distribution (Policy), Project purposes, Water policy, Water resources, Cost-benefit analysis, Federal project policy, Federal government, Flood control, Pollution abatement, Recreation, Irrigation, Water levels, Navigation, Hydroelectric plants, Interbasin transfers, Legislation, Inter-agency cooperation, Administration, Wildlife conservation.
Identifiers: *Missouri River Basin.

A description of the Missouri River Basin, the state of its 1944 development, and the Bureau of Reclamation's plan for its future development are presented in this report. The plan described deals with the conservation and control of water resources in the Basin and the use of such resources in watershed development. The plan encompasses all water resources and all feasible beneficial uses of water, including: (1) aids to navigation (2) flood control, (3) irrigation, (4) power production, (5) the restoration of surface and groundwater le and municipal and domestic water supplies, abatement of stream pollution, (7) silt control, fish and wildlife preservation, and (9) recreat Dams, hydroelectric plants, reservoirs, and o projects designed to maximize beneficial us water resources are analyzed in terms of an project costs, benefits, and repayment and re schedules. Six geographical areas within the b are examined as to: (1) such factors as land water quality, climate, minerals, markets and tr portation, surface and groundwater resources, soils; (2) existing state of water resources deve ment; and (3) future projects and plans development. A detailed physical and econo description of the entire Basin is also presen (Earl-Florida)
W71-04986

FISHERIES AND THE NEW CONVENTIO ON THE LAW OF THE SEA,
Francis T. Christy, Jr.
San Diego Law Review, Vol 7, No 3, p 455-4 July 1970. 14 p, 2 tab, 17 ref.

Descriptors: *Marine fisheries, *International l *International commissions, *International wat Commercial fishing, Fish, Fish harvest, F hatcheries, Fish migration, Fishing, Fish mana ment, Fish populations, Commercial fish, Le aspects, Mineralogy, Mineral industry, Uni States, Foreign countries, Treaties.

The Geneva Conventions on the Law of the Sea expected to consider problems of internatio marine fisheries, although debate has previou been exclusively devoted to marine mine resources and military interests. The author ticipates difficulty in solving the problems of c flicting national interests in marine fisheries raises five points to be considered by the delega to the commission: (1) despite the inordinate co plexity of fisheries problems, the issues and alter tive solutions have not been formulated with p ticularity; (2) over-emphasis on seabeds may ca short-term gains for mineral interests at the pense of long-term damages to fisheries intere (3) the character of the Conventions will be far ferent from the 1958 Conventions, because of split between developing and developed nati and fear of a U.S.-U.S.S.R. fisheries coalition; the world community is realizing that the patte of distribution of the sea's wealth in fishe among nations is becoming more non-inclusi and the opportunities for sharing more restricti and (5) the non-inclusive patterns of distributi are supported by customary and conventional l The author feels that the delegates to the Conv tions are unprepared to adequately discuss fisheries problems and hopes the Conventions be delayed until the issues become clearer. (Ha Florida)
W71-04987

ADARAY REALTY CORP V FABI (RESTORATION OF UPLAND TITLE I FILLING SUBMERGED LAND).
235 NYS 660-661 (Sup Ct App Div 1929).

Descriptors: *New York, *Riparian land, *Lan fills, *Ownership of beds, Riparian waters, Ripari rights, Dredging, Land forming, Beds, Shor Seashores, Oceans, Beach erosion, Banks, Ba erosion, Erosion, Land tenure, Boundaries (P perty), Boundary disputes, Legal aspects, Judic decisions.

Plaintiff realtor brought action against defend riparian owner to settle a dispute over boundar of property subject to a sale contract in which fendant was vendor. Plaintiff contended that defe dant's title was defective because a large part of fendant's upland had been lost due to croachment by the ocean at the time of contra execution. Defendant contended that his title h been restored, since the city had filled in the la prior to the closing date. The Supreme Court

ew York noted that one holding title to sub-erged land could restore his upland by filling, hereas title to land vested in the state could not be ained by filling. The court held that plaintiff failed prove that title to the submerged land was in the ate rather than defendant and thus failed to show at defendant could not restore his upland by ling. Judgment for defendant was affirmed. (Lip-k-Florida)
71-04988

L POLLUTION AT SEA,
r primary bibliographic entry see Field 05G.
71-04989

L POLLUTION AND THE LAW,
r primary bibliographic entry see Field 05G.
71-04990

L SPILLAGE PREVENTION, CONTROL, ID RESTORATION--STATE OF THE ART ID RESEARCH NEEDS,
r primary bibliographic entry see Field 05G.
71-04991

L POLLUTION: A REPORT TO THE PRE-DENT.
r primary bibliographic entry see Field 05G.
71-04992

TIONAL MULTI-AGENCY OIL AND ZARDOUS MATERIALS POLLUTION CON-NGENCY PLAN.
primary bibliographic entry see Field 05G.
1-04993

SE USE OF FLOOD PLAINS.
w England River Basins Commission, Boston, ss.
primary bibliographic entry see Field 06F.
1-04994

RFACE WATER CONTROL IN NEW JER-Y, DRAINAGE, FLOOD CONTROL AND RE-TED POLICIES IN AN URBAN STATE,
gers-The State Univ., New Brunswick, N.J. Bu-u of Government Research.
primary bibliographic entry see Field 04A.
1-04995

SUMMARY OF MASSACHUSETTS STATE WS, POLICIES AND PROGRAMS PERTAIN-TO WATER AND RELATED LAND SOURCES.
sachusetts Water Resources Commission, on. Div. of Water Resources.

9. 127 p, 2 chart.

criptors: *Massachusetts, *water resources, ter law, *Water policy, Development, Legal cts, Project purposes, Project planning, ning, Administration, Administrative agencies, -state commissions, River basin commissions, ershed management, Water quality control, Ju-l decisions, Legislation, Riparian rights, Con-ation, Land, Financing, Eminent domain, ic rights.

zing constitutional and statutory provisions, 12 rtant state court decisions, and several signifi-attorny general opinions, this report contains a psis of all Massachusetts law relative to water rces. Included in the report are discussions of: he state's riparian rights doctrine, (2) private public rights in surface and groundwater, (3) ss to lakes and streams, (4) interbasin diver-, and (5) eminent domain problems. The re-lists the projects for which permits or approval eeded and the responsible agency's function in ing such permits. Also described, along with a chart of the state government and a reorganization of state agencies to be implemented in 1971, are the organization and functions of four interstate and 21 state commissions and agencies having jurisdiction over water resources problems. Different policy and management approaches and concepts are discussed and compared. The report describes also programs in research, data collection and interpretation, planning, construction and development, regulation, drainage, irrigation, erosion control, and reservoir sites. The report discusses projections of policy, program trends, and future financing prospects, and concludes with a summary of water management problems in the areas of water supply, flood control, forestry and watershed management, hydropower, water quality control, and recreation. Specific recommendations for solving some of these problems are presented. (Liptak-Florida)
W71-04996

WATER RESOURCES PLANNING SEMINAR,
Florida State Board of Conservation, Tallahassee. Div. of Water Resources and Conservation.
For primary bibliographic entry see Field 06B.
W71-04997

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 7, SECTION I - FIVE LEGAL STUDIES ON WATER QUALITY MANAGEMENT IN WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05040

HAYNIE V MAY (TITLE TO ACCRETED LANDS WHEN ADJACENT UPLAND IS CONVEYED).

252 NW 749-754 (Iowa 1934).

Descriptors: *Iowa, *Accretion (Legal aspects), *Missouri River, *Boundary disputes, Boundaries (Property), Contracts, Adjudication procedure, Legal aspects, Judicial decisions, Real property, Land tenure, Navigable waters.

In a suit to quiet title to riparian land, the Supreme Court of Iowa stated that by recording his deed and plat, and holding himself out as the owner of the disputed land, plaintiff had acquiesced in the description of the property in the deed although a court would have decided title to the accretions differently. In a later contract for sale of the same land utilizing the identical description, plaintiff was held to have conveyed title to the accretions as well as the upland. (Hart-Florida)
W71-05106

LOUISIANA V MISSISSIPPI (BOUNDARY DISPUTE BETWEEN STATES, INVOLVING ACCRETION AND SUBSEQUENT AVULSION).
282 US 458, 51 S Ct 197-201 (1931).

Descriptors: *Louisiana, *Mississippi, *Accretion (Legal aspects), *Boundary disputes, Local governments, Judicial decisions, Remedies, Legal aspects, Mississippi River, Navigable rivers, Navigable waters, Islands, Channel erosion, Banks, Bank erosion, Avulsion, Boundaries (Property), Interstate rivers.

Louisiana brought suit to determine the location of the boundary between a portion of Louisiana and a portion of Mississippi. Louisiana contended that the thread of the Mississippi River channel had moved gradually eastward between 1823 and 1913, with an island disappearing and land accreting to the Louisiana shore and becoming part of Louisiana. An avulsion in 1912 to 1913 changed the channel westward, cutting off the land that had previously attached to Louisiana. Louisiana claimed that the avulsion did not change the boundary previously formed by accretion. Mississippi agreed that the 1912-1913 avulsion did not change the boundary, but contended that the earlier eastward movement of the river channel was an avulsion rather than accretion, thus the land had remained in Mississippi. The Supreme Court of the United States, in accepting a master's report, held the eastward change was by accretion, thus Louisiana gained the Land. The court also noted that evidence was inconclusive to show Mississippi had exercised continued dominion over the land or that Louisiana had acquiesced in any such dominion. (Morris-Florida)
W71-05117

NEW JERSEY V CITY OF NEW YORK (CITY DUMPING GARBAGE IN OCEAN AS NUISANCE).
283 US 473, 51 Sup Ct 519-522 (1931).

Descriptors: *New Jersey, *Domestic wastes, *Water pollution, *Water pollution effects, Water pollution sources, Water pollution control, Pollution abatement, Pollution identification, Legal aspects, Judicial decisions, Remedies, Permits, State governments, Local governments, Garbage dumps, Municipal wastes, Incineration, Oceans, Atlantic Ocean, Beaches, Shores, Cities.

Plaintiff state sought to enjoin defendant city from dumping garbage in the ocean. Plaintiff claimed the garbage washed ashore on its beaches, causing a health menace and great expense to the state and its resorts. Defendant asserted that the dumping was done under federal permit and outside the territorial waters of the United States and thus was outside the Court's authority. Defendant also claimed that other sources also dumped waste in the same area and that it would be impossible to attribute the injury to defendant. The Supreme Court of the United States accepted a master's finding that the garbage did constitute a nuisance and that the defendant was the primary source of the garbage. The Court also noted that defendant had been aware of the nuisance for years and had not acted sufficiently to remove it, although defendant also used some incinerators to destroy garbage. The Court held that the permit did not relieve defendant of liability for a nuisance and that the situs of the dumping was unimportant since the site of the injury and both parties were within the Court's jurisdiction. (Morris-Florida)
W71-05125

SMOOT SAND AND GRAVEL CORP V WASHINGTON AIRPORT, INC (BOUNDARY DISPUTES BETWEEN STATES ON THE POTOMAC RIVER).
283 US 348, 51 Sup Ct 474-476 (1931).

Descriptors: *Virginia, *Maryland, *Boundary disputes, *Interstate rivers, District of Columbia, Local governments, Federal government, Legal aspects, Judicial decisions, High water mark, Low water mark, Legislation, Boundaries (Property), Riparian land, Navigable waters, Banks, Rivers.
Identifiers: *Potomac River.

Plaintiff airport sought to enjoin defendant gravel corporation from trespassing on land between the high and low water marks on the Virginia side of the Potomac River, opposite the District of Columbia. Plaintiff brought suit in Virginia, but a federal district court dismissed for lack of jurisdiction over the area. The question which faced the Supreme Court of the United States was whether the boundary line between Virginia and the District of Columbia is the high or low water mark on the Virginia side of the Potomac. The Court held that the original conveyance to Lord Baltimore was along the farther bank of the river, which would mean the high water mark. Thus the Court held that Virginia courts would not have jurisdiction over the area. A dissenting opinion claimed the decision was contrary to the Court's earlier holding that the Compact of 1785 between Virginia and Maryland set Maryland's southern boundary at the low water mark of

the south bank of the Potomac. The District retained Maryland's boundary when it was created. (Morris-Florida)
W71-05133

VERMONT V NEW HAMPSHIRE (BOUNDARY DISPUTE INVOLVING RIVER BETWEEN STATES).

289 US 593, 53 Sup Ct 708-718 (1933).

Descriptors: *Vermont, *New Hampshire, *Boundary disputes, *Interstate rivers, Low water mark, High water mark, Legal aspects, Judicial decisions, Local governments, Federal government, Boundaries (Property), Legislation, Navigable waters, Navigable rivers, Rivers, Banks, Riparian land, River beds, Ownership of beds, Vegetation, Shoreline cover.

The state of Vermont brought a suit to determine the boundary line between Vermont and the state of Massachusetts. Vermont asserted the boundary should be the thread of the channel of the Connecticut River. Massachusetts claimed the boundary should be the top of the western bank of the river, which would mean the line where vegetation ceases. Both states relied on various historical and colonial documents, but no dispute had occurred between them until New Hampshire attempted to tax corporations and persons with structures on the west bank. A special master concluded that the ordinary low water mark on the western side of the river was the proper boundary. The master based his opinion on the congressional resolution of 1781 setting terms for Vermont's admission to the Union and the Vermont legislature's resolution of 1782 relinquishing claims east of the low water mark in accordance with congressional wishes. The Supreme Court of the United States adopted the master's report, based on the acts of the states and their inhabitants in relying on the low-water mark for over 100 years. (Morris-Florida)
W71-05140

NEW JERSEY V CITY OF NEW YORK (REMEDY AGAINST CITY FOR POLLUTION OF STATE WATERS AND BEACHES).
290 US 237, 54 Sup Ct 136-137 (1933).

Descriptors: *New Jersey, *Water pollution, *Domestic wastes, *Waste disposal, Oceans, Shores, Coasts, Cities, Beaches, Incinerators, Damages, Remedies, Costs, Wastes, Judicial decisions, Legal aspects, Water pollution sources, New York.

Plaintiff state of New Jersey sought to enjoin defendant city of New York from dumping garbage into the ocean, thereby polluting New Jersey waters and beaches. The Supreme Court of the United States appointed a special master to hear the case. The master found that defendant had created and was continuing to create a public nuisance and that plaintiff was entitled to the relief prayed for. He recommended that defendant be given a reasonable time in which to install incinerators to dispose of its garbage. The Court approved the master's report and issued a decree specifying a time after which the injunction would take effect. Defendant failed to install the incinerators in time to comply with the decree, and plaintiff filed a petition asking defendant to show cause why it should not be held in contempt. Defendant answered that inadequate financial means had caused the delay and prayed for an extension. The Supreme Court granted the extension, awarded damages to plaintiff for expenditures by its political subdivisions in dealing with the pollution, and provided for a daily penalty if defendant did not comply with the decree within the new time limit. (Duss-Florida)
W71-05142

NEW JERSEY V CITY OF NEW YORK (OFFSHORE SEWAGE SLUDGE DISPOSAL).
296 US 259, 56 Sup Ct 188 (1935).

Descriptors: *New Jersey, *New York, *Sewage disposal, *Waste disposal, Waste water disposal, Municipal wastes, Sanitary engineering, Sludge disposal, Waste dumps, Wastes, Legal aspects, Judicial decisions, Cities, Water pollution, Adjudication procedure, Water pollution control.

Plaintiff state obtained an injunction prohibiting defendant municipality from dumping refuse into the ocean waters off the coast of plaintiff. Defendant dumped nonfloating sewage sludge consisting of 90 percent water and 10 percent finely divided solids at places not less than 10 miles from plaintiff's shore. Defendant filed a petition for construction or modification of the injunction decree to determine if defendant had violated the court order. The United States Supreme Court held that the dumping of sludge, free from any matter capable of floating, was not a violation of the decree. (Powell-Florida)
W71-05146

PROPERTY: THE FIXED LAW OF CHANGING BOUNDARIES,
Douglas H. Lefeve, and Ernest G. Taylor.
Mississippi Law Journal, Vol 41, No 2, p 444-456, 1970. 13 p, 96 ref.

Descriptors: *Boundaries (Property), *Accretion (Legal aspects), *Avulsion, *Thalweg, Boundary disputes, Bank erosion, Riparian land, Riparian rights, Riparian waters, Judicial decisions, Legal aspects, Rivers, Navigable rivers, Streams, Mississippi River, Prescriptive rights, Adjudication procedure.

In this note pertaining to changes in size and shape of land bordered by a river or stream, the following riparian doctrines are discussed: (1) accretion, (2) thalweg, (3) avulsion, and (4) prescription and acquiescence. Accretion is defined as an imperceptible increase in riparian land by either natural or artificial means. The author states that title to an accretion is vested in the riparian owner whose land to which it attached. The origin and justifications for the accretion doctrine are analyzed. Thalweg is defined as the middle or thread of a navigable river forming the boundary between coterminous states. Since the thalweg changes continuously, the author notes that the states' boundary varies with it. This prevents one state from excluding the other from its right of navigation. Avulsion is defined as a stream's sudden departure from its old bed into a new one. It is stated that avulsion causes no legal change in boundaries. The prescription and acquiescence doctrine allows a state to acquire land originally belonging to another. The procedural problems of litigation and disputes are discussed, and the author concludes that the avulsion rule should be eliminated. (Hart-Florida)
W71-05179

COUNCIL ON ENVIRONMENTAL QUALITY; STATEMENTS ON PROPOSED FEDERAL ACTION AFFECTING THE ENVIRONMENT.
Federal Register, Vol 36, No 19, Thursday, January 28, 1971, p 1398-1402.

Descriptors: *Environmental effects, *Administrative agencies, *Project planning, *Decision making, Conservation, Federal government, United States, Administration, Planning, Natural resources, Legislation, Water resources development, Adoption of practices, Legal aspects, Governments, Costs, Jurisdiction.
Identifiers: *National Environmental Quality Act.

To implement the purposes of the National Environmental Quality Act, the Council on Environmental Quality herein proposes guidelines for the preparation of statements on proposed federal action affecting the environment. The Act requires all federal agencies anticipating proposals for legislation, or other agency action having potential effect on the quality of the environment, to prepare a detailed statement outlining the environmental impact of the proposal. The guidelines describe agency procedures, which actions are considered with the Act, and which agencies are responsible preparing statements. Statements are to include probable impact of the proposed action on the vironment, adverse environmental effects w cannot be avoided, analysis and costs of alterna action, the relationship between short-term long-term effects of the action, any irrever committments of resources involved in the act and any discussion or objection raised by o federal, state, or local agencies. Federal agen having jurisdiction or expertise in certain a must be consulted and are listed in an appen Action should not be taken until the Council had at least 90 days to consider the statement. procedure also allows for state and local rev public hearings and public dissemination of the vironmental statements. (Liptak-Florida)
W71-05180

THE BACKGROUND OF THE DOCTRINE THE CONTINENTAL SHELF AND THE OUT CONTINENTAL SHELF LANDS ACT,
Nossaman, Waters, Scott, Krueger and Riord Los Angeles, Calif.
Robert B. Krueger.
Natural Resources Journal, Vol 10, No 3, p 4 514, 1970. 73 p, 4 fig, 191 ref, 5 append.

Descriptors: *Continental Shelf, *Exploitat *History, *International law, Legislation, For countries, United States, Continental sh Mineralogy, Oceans, Submerged Lands Act, L aspects, Judicial decisions, United Nations, Oil, wells.
Identifiers: *Outer Continental Shelf Lands Act

The necessity for exploitation of offshore min resources is directly related to the developmen the Continental Shelf doctrine. The purpose of article is to examine the background of the c trine and the Outer Continental Shelf Lands A The controversy within the United Nations c use and jurisdiction of riparian nations in the C tinental Shelf is discussed. In examining background of the Outer Continental Shelf La Act, the author considers: (1) the Submer Lands Act, (2) the 1945 Truman Proclamation, the Outer Continental Shelf Lands Act, (4) 1958 Geneva Convention on the Continental Sh (5) customary international law, and (6) the 1 Nixon proposal for the United States ocean pol In his discussion of the 1958 Geneva Convent the author analyzes; (1) preconvention claims, definition of the Continental Shelf, (3) provisi of the Convention, (4) claims under the Conv tion, and (5) recent international developme Five appendices set forth: (1) the Submer Lands Act; (2) the Convention on the Territo Sea and the Contiguous Zone; (3) the Outer C tinental Shelf Lands Act; (4) the Truman Pro mation; and (5) the Convention on the Continen Shelf. (Hart-Florida)
W71-05181

SOME LEGAL PROBLEMS INVOLVED IN SA ING GEORGIA'S MARSHLANDS,
Fiquilliat and Abbot, Savannah, Ga.
Laurie K. Abbott.
Georgia State Bar Journal, Vol 7, No 1, p 27- 1970. 10 p.

Descriptors: *Georgia, *Marshes, *Estuar *Tidal marshes, Legal aspects, Legislation, A ministrative agencies, State governments, La reclamation, Marsh management, Judicial de sions, Eminent domain, Coordination, Perm Land fills, Real property, Land tenure, Dredging

There are many conflicting uses for Georg coastal marshlands. This article examines the le difficulties involved in conserving th marshlands. An act in 1860 extended title from uplands to the low water mark of adjacent navi ble streams; accordingly, holders contiguous to marshlands considered them their own. Howeve later Georgia Supreme Court decision held that act did not apply to marshlands. This defect w

ired by legislation and a constitutional amendent. In 1970, the Georgia Attorney General held at the marshlands belonged to the state. The thor analyzes the Attorney General's opinion, ncluding that its foundation is tenuous. Next, the thor examines the Coastal Marshlands Protecn Act which requires a permit from the Coastal arshlands Protection Agency for dredging and ing in the marshlands. It is stated that this act ist withstand three tests: (1) Can zoning power delegated to a state agency; (2) Is the agency's usal to grant a permit an uncompensated taking thout due process; and (3) Is a permit applicant orded due process by the procedures set forth in act. (Hart-Florida)
71-05182

ORIDA BARGE CANAL.
ngressional Quarterly, Vol 29, p 199, 202, Jan 71. 2 p.

scriptors: *Florida, *Canal construction, *Natu- resources, *Canals, Conservation, Construc-, Construction costs, Rivers, Streams, Naviga-, Governments, Decision making, Land ources, Water resources development, Wildlife servation, Preservation, Water policy, Transtation, Ships, Economics, Environmental effect. ntifiers: *Executive orders.

lowing the advice of the Council on Environntal Quality, President Nixon ordered the Army ps of Engineers to stop construction on the ss-Florida barge canal. The stop order was oped by Florida's Congressional delegation, which nned to meet to consider possible counter meaes. Conservationists opposed the canal because ould damage the unique wildlife and natural i-tropical beauty in that part of the state. Conationists had successfully obtained a temporary rt order halting the canal and, prior to the Prent's order, had planned continuing litigation. text of the President's statement noted that the al was conceived when federal planning was sed purely on economic return without regard destruction of the ecology as a cost factor. The ident pointed out the uniqueness of the re's wildlife resources, describing it as a 'natural sure.' The President also asked the Secretary of Army to aid the Council on Environmental lity in developing recommendations for the fuuse of the canal area. (Liptak-Florida)
-05183

MITS FOR DISCHARGES OR DEPOSITS O NAVIGABLE WATERS.
ps of Engineers, Washington, D.C.

eral Register, Vol 35, No 253, Thursday, ember 31, 1970, p 20005-20009.

criptors: *Navigable waters, *Waste disposal, mits, *Rivers and Harbors Act, Administra- Wastes, Environmental effects, Conservation, ed States, Natural resources, Legislation, ulation, Water quality, Administrative agen- Project planning, Decision making, Adoption ractices, Water pollution control, Pollution ement, Effluents, Waste water (Pollution), er quality control, Pollutants, Administrative ions, State governments
tifiers: Administrative regulations.

uant to Executive Order 11574 directing the ementation of a permit program under the se Act, the Secretary of the Army herein oses the policy, practice, and procedure to be wed by the Corps of Engineers in granting perauthorizing the discharge of refuse or other er into United States navigable waters. As a ral policy, all discharges into navigable waters nlawful and will only be authorized after an ation of the probable impact on: (1) orage and navigation, (2) applicable water ty standards, and (3) fish and wildlife. The s will not issue a permit where the state has decertification under the Federal Water Pollution Control Act, and the findings of the Environmental Protection Agency as to probable impact upon water quality standards will be followed. Permit applicants must supply specified information on the character of the proposed discharge and must also furnish state certification. The Corps will furnish copies of the application to the EPA and other interested agencies for their views and recommendation. The Corps shall give public notice of the application and may hold a public hearing. If the discharge will have a significant environmental impact, the Corps must submit an environmental impact statement to the Council on Environmental Quality. Permits may not be issued for more than 5 years without providing for revalidation. (Liptak-Florida)
W71-05184

DEEP SEA MINING,
F. M. Auburn.
American Bar Association Journal, Vol 56, p 975-976, 1970. 2 p, 7 ref.

Descriptors: *International law, *Continental Shelf, *Continental Margin, *Exploitation, Law of the sea, International waters, Mining, Regime, Regulation, Beds under water, Administrative agencies, Administration, Jurisdiction, United States, United Nations, Federal government, Governments, Oil industry, Treaties, Political aspects, Political constraints, Institutional constraints, Boundary disputes, Legal aspects, Judicial decisions.
Identifiers: *Deep sea mining.

Evaluated in this article are recent proposals, United Nations proceedings, and court decisions relating to exploitation of the ocean bed, Continental Shelf, and Continental Margin. Three United Nations resolutions dealing with this area are considered. Concurrent, and often conflicting, developments within the United States are reviewed. The views of the American Petroleum Institute, the United States Navy, the Department of the Interior, and the federal courts are compared with attempts to establish international regimes to govern such areas. The author suggests that a recent proposal by President Nixon may serve as a basis for resolving both international and domestic conflicts in the area of deep-sea exploitation. The Nixon Proposal of May 25, 1970, suggests an international treaty renouncing all national claims to sea-bed resources below 200 meters. It would provide for: (1) an international regime to exploit such resources, (2) coastal states to act as trustees, and (3) machinery to regulate exploitation beyond the Continental Margin. The proposal is examined and evaluated by the author, who suggests possible amendments. (Earl-Florida)
W71-05185

WATER RESOURCES COUNCIL; COUNCIL ORGANIZATION.
Water Resources Council, Washington, D.C.

Federal Register, Vol 35, No 146, Wednesday, July 29, 1970, p 12105-12113.

Descriptors: *Water Resources Planning Act, *Administrative agencies, *Grants, *Administrative decisions, Federal government, Adoption of practices, Institutional constraints, Inter-agency cooperation, Decision making, Leadership, Organizations, Regulations, Coordination, Management, Personnel management, Project-planning, Federal project policy, Water resources, Legislation, Allotments, Legal aspects.
Identifiers: *Water Resources Council.

Set forth in this administrative promulgation is a description of the organizational structure, functions, and grant procedures of the Water Resources Council. The Council's basic authority under the Water Resources Planning Act, its purposes, functions, organizational pattern, and office locations are set forth. The responsibilities and structure of the Council are described, including: (1) the Council itself; (2) decisions by members and representatives; (3) the role of associate members and observers; (4) subordinate groups, (5) the Secretary, Chairman, Director, and other officers; (6) official decisions; and (7) delegation of the Director's powers. The Council's field organization, including field directors, field committees, and existing committees, is also set forth. Council regulations and procedures applicable to grants to the states under the Water Resources Planning Act are provided, listing: (1) allotment criteria; (2) application procedures; (3) federal agency coordination considerations; (4) annual reporting and review requirements; and (5) other grant standards and regulations. (Earl-Florida)
W71-05186

WATER RESOURCES COUNCIL; POLICIES AND PROCEDURES IN PLAN FORMULATION AND EVALUATION OF WATER AND RELATED LAND RESOURCES PROJECTS.
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 06C.
W71-05187

RECLAMATION AND IRRIGATION OF LANDS BY FEDERAL GOVERNMENT.

43 USCA secs 425 thru 425b, 616 mmmm thru 616 yyyy (Supp 1970).

Descriptors: *Irrigation programs, *Irrigable land, *Federal project policy, *Federal reclamation law, Arid lands, Legal aspects, Public lands, Reclamation, Irrigated land, Irrigation, Irrigation effects, Irrigation systems, Irrigation water, Administrative agencies, Federal government, State governments, Local governments, Cities, Recreation, Wildlife conservation, Fish conservation, Cost repayment, Oregon, Washington, Legislation, State governments.
Identifiers: *Federal Water Project Recreation Act.

Those provisions of federal reclamation laws which limit the acreage of irrigable land which may receive irrigation benefits shall not be applicable to lands owned by states, political subdivisions and agencies thereof, so long as such lands are farmed as herein provided. Under the conditions here set forth, irrigable state-owned lands may receive water from federal reclamation projects. Lessees of state-owned irrigable lands which are subject to the acreage limitation may receive project waters for up to a limit of 25 years. This act also authorizes the construction, operation and maintenance of: (1) the Merlin Division of the Rogue River Project in Oregon, and (2) the Touchet Division of the Walla Walla Project in Oregon and Washington. Standards are prescribed for these projects. In both projects conservation and the development of fish and wildlife resources, and the enhancement of recreation opportunities, shall be in accordance with the Federal Water Project Recreation Act. Irrigation repayment contracts must provide for cost repayment within 50 years. (Hart-Florida)
W71-05188

SHELDON V SEVIGNY (BOUNDARY OF PROPERTY ABUTTING ON A STREAM).

272 A2d 134-137 (NH 1970).

Descriptors: *Streams, *Boundary disputes, *Boundaries (Property), *New Hampshire, Surveys, Land tenure, Real property, Zoning, Septic tanks, Cities, Legal aspects, Judicial decisions.

Plaintiff landowner brought action to prevent defendant adjacent landowner from installing a septic tank within the confines of plaintiff's land and thereby violating a zoning ordinance. The case evolved into a boundary dispute between the two lots purchased from a common grantor. Both deeds described the common boundary as running along the bank of a brook. Plaintiff contended that the

surveyor's measurements were from the thread of the brook when they should have been from the bank. Defendant supported the survey. The court stated that in the absence of a clearly expressed intent to limit a grant to the bank, title runs to the thread of the stream. Since no such intent was found, the court rejected plaintiff's contention. (Hart-Florida)
W71-05189

REGULATION OF TRANSPORTATION IN INTERSTATE OR FOREIGN COMMERCE OF BLACK BASS AND OTHER FISH.
16 USCA secs 851 thru 852d (Supp 1970).

Descriptors: *Fish, *Transportation, *Bass, *Fish conservation, Legislation, Administrative agencies, Foreign countries, Federal government, Regulation.
Identifiers: *Interstate commerce.

The transportation of any black bass or other fish in interstate or foreign commerce with knowledge that the transportation is contrary to the law of the state in which the fish originated, or that the fish were illegally caught, is prohibited. Moreover, purchasing or receiving any fish with knowledge that the fish were transported in violation of this act is unlawful. Receiving black bass or other fish with knowledge that a false record of the shipment was made is also unlawful. Containers in which fish are shipped must be conspicuously marked 'fish', and the name and address of the shipper and the consignee must be included. Employees of the Department of the Interior are authorized to enforce the act and are empowered: (1) to arrest without a warrant any person violating the provisions in his presence; (2) to execute any warrants issued to enforce the act; and (3) to make searches under a valid warrant. Warrants may be issued upon probable cause. (Hart-Florida)
W71-05190

ANIMALS, BIRDS, FISH AND PLANTS (SPECIFIC TRANSPORTATION OF, AND DEALINGS IN, WILDLIFE AS ILLEGAL).

18 USCA secs 43 thru 44, as amended, (Supp 1970).

Descriptors: *Wildlife conservation, *Fish, *Transportation, *Wildlife, Legislation, Administrative agencies, Animals, Birds, Plants, Remedies, Federal government, Foreign countries, Administration, Regulation, State governments, United States, Mexico, Permits.
Identifiers: *Interstate commerce.

It shall be a violation of this act for any person to: (1) transport or deal in wildlife in violation of an act of Congress; (2) transport or deal in wildlife in violation of state law or the law of a foreign nation; (3) sell products manufactured from wildlife in violation of an act of Congress; (4) sell products manufactured from wildlife; (5) make a false record of wildlife shipped in interstate commerce; (6) purchase any wildlife for commercial purposes which was taken in violation of an act of Congress or in violation of the law of a state or foreign nation; or (7) import any wild game from Mexico without a permit from the Secretary of the Interior. Violators shall be subject to the following penalties: (1) a civil penalty of $5000 for violation with actual or imputed knowledge; (2) a criminal penalty, for knowing and willful violation, of up to $10,000 and/or one year imprisonment. Any wildlife seized shall be forfeited to the Secretary of the Interior. Employees authorized by the Secretary to enforce the act may execute warrants to search for and seize wildlife or wildlife products. (Hart-Florida)
W71-05191

NATIONAL FLOOD INSURANCE (EXTENSION OF FLOOD INSURANCE TO MUDSLIDES).

42 USCA secs 4001, 4012c, 4022, 4056, 4121 (Supp 1970).

Descriptors: *Mudflows, *Insurance, *Flood damages, *Flood plain insurance, Legislation, Damages, Compensation, Legal aspects, Risks, Mud, Floods, Administrative agencies, Federal government, Land use, Administration.

Since damage and loss resulting from mudslides is related to storms and floods, this amendment makes national flood insurance applicable to mudslides. The term 'flood' for the purposes of flood insurance programs also includes inundation from mudslides. However, insurance is available only in areas which have satisfied the Secretary of Housing and Urban Development that adequate land use and control measures will be implemented. (Hart-Florida)
W71-05192

MARTIN V BUSCH (OWNERSHIP OF LAKEBEDS RELICTED BY STATE DRAINAGE OPERATION).
112 So 274-288 (Fla 1927).

Descriptors: *Florida, *Land tenure, *Ownership of beds, *Boundary disputes, Boundaries (Property), Beds under water, Beds, Lakes, Littoral, Navigable waters, Riparian land, Riparian rights, Accretion (Legal aspects), Administrative agencies, Real property, State governments, Reservation doctrine, Judicial decisions, Legal aspects, High water mark.

Plaintiff swampland owner sought to quiet title to lands against claims of defendant Florida Improvement Fund trustees. The disputed land was coveyed to plaintiff's predecessor by defendant before Lake Okeechobee was meandered. The boundary of the conveyance was Lake Okeechobee. After the conveyance, defendants had the lake meandered. Due to a drainage operation by the state, the lake had receded. Both parties claimed the land between the high water mark at the time of the conveyance and the meander line. The Supreme Court of Florida stated that: (1) 'navigable waters' include all waters capable of practical navigation for useful purposes; (2) on admission to the Union, the state became owner of beds of navigable lakes to high water mark; (3) best evidence and methods should be used to determine the location of the high water mark; (4) lands below high water mark are 'sovereignty lands,' while those above are 'swamp lands'; and (5) right to land below high water mark must be specifically claimed. The court further noted that relicted land does not inure to a riparian owner where it recedes as a result of a state drainage operation for a public purpose. Since defendant had no authority to convey beds of navigable waters, the court held title in defendant. (Hart-Florida)
W71-05193

WATER PROJECTS -- A CHANGING PERSPECTIVE,
Sierra Club, San Francisco, Calif.
For primary bibliographic entry see Field 06B.
W71-05195

UNITED STATES V MAYOR AND CITY COUNCIL OF HOBOKEN (DOCKS MAY BREACH RIGHT OF RE-ENTRY FOR CONDITION BROKEN).

29 F2d 932-949 (D NJ 1928).

Descriptors: *New Jersey, *Docks, *Land tenure, *Ownership of beds, Beds, Beds under water, Cities, State governments, Hudson River, Rivers, Navigable rivers, United States, Taxes, Legal aspects, Judicial decisions.

Plaintiff United States brought action to have realty located within defendant city declared permanently tax exempt. The property was a portion of the Hudson River's bed which had been conveyed to a German Steamship line by defendant. A convenant in the conveyance prohibited erection of any structure which would obstruct public view. However, the steamship company had erec docks on the property. Plaintiff condemned property under a statute allowing condemnation German property during World War I. The par agreed that plaintiff was exempt from taxation, defendant contended that plaintiff did not own property when the tax was imposed, because taking was unconstitutional. Defendant's cont tion was rejected by the United States distr court. However, the court observed that the c veyance had apparently been broken, and that parently the state of New Jersey, which originally conveyed the land to defendant, ha right of re-entry. (Hart-Florida)
W71-05203

AMERICAN TITLE AND TRUST CO V GU REFINING CO (DISPUTE OVER LAND CO VEYED IN PATENT FROM ENGLISH CROW
72 F2d 248-251 (2d Cir 1934).

Descriptors: *Land tenure, *Boundaries (Prop ty), *Islands, *Intertidal areas, High water ma Low water mark, Shores, Boundary disputes, R property, Beaches, Adjudication procedure, Ju cial decisions, Legal aspects, New York.

Plaintiff landowner brough an action of ejectme against defendant landowner. Plaintiff claimed ti to lands between high and low water marks on island under a patent to his predecessor from t English Crown. The patent conveyed 'all Vaca and unappropriated Land and Meadow on Stat Island.' The Second Circuit Court of Appeals he that this description did not extend beyond the hi water mark. Plaintiff offered to prove that t foreshore was geologically part of the island, b the court rejected the offer, since the grant w unambiguous. A governmental conveyance shou not rest on implication, but appear expressl Determining that the patent was not ambiguous as to require extrinsic evidence to construe it, t court held that the patent had not conveyed t foreshore. (Hart-Florida)
W71-05204

SINCLAIR REFINING CO V BENNETT (PO LUTION OF WELLS BY GASOLINE LEAK).
123 F2d 884-887 (6th Cir 1941).

Descriptors: *Shallow wells, *Water pollutic sources, *Gasoline, *Damages, Oil industry, Wat pollution effects, Water pollution, Pollutants, Im paired water quality, Pollutant identification, Odo Taste, Adjudication procedure, Legal aspects, J dicial decisions.

Plaintiff landowner sued defendant refining con pany for damages caused by gasoline pollution plaintiff's wells. Defendant leased a gasoline fillin station on contiguous premises. Gasoline leake from a faulty pipe joint on one of defendant's g tanks and soaked into the ground and into plai tiff's wells. Defendant contended that the evidenc did not support the verdict and that the damage were excessive, since awarded for permanen rather than temporary injury. The Sixth Circu Court of Appeals held that the evidence supporte the verdict. Reviewing uncontradicted testimon that known gasoline-polluted wells had not becom decontaminated for many years, and determinin that the disputed wells still had a gasoline odo after 6 years, the court held that the lower cou had properly awarded damages for permanent inju ry. (Hart-Florida)
W71-05207

COLE V AUSTIN (SUBMERGED FERR CABLE AS OBSTRUCTION TO NAVIGATION).
140 A 108-114 (Conn 1928).

Descriptors: *Connecticut, *Navigable waters *Navigation, *Boats, Islands, Piers, Riparian land Riparian waters, Riparian rights, Public rights Legal aspects, Judicial decisions.
Identifiers: Nuisance (Public).

in an action to quiet title to land, plaintiff riparian owner also sought to enjoin defendant from maintaining a ferry cable between defendant's island and the mainland. Plaintiff contended that the cable was a nuisance and an obstruction to navigation. Affirming a judgment for defendant, the court noted that a ferry cable does not obstruct navigation when, as in this case, it lay on the bottom and was only picked up by the ferry as it passed overhead. The court also noted that plaintiff had shown no special injury, different in kind from that suffered by the general public, and therefore could not maintain an action to enjoin a public nuisance. (Liptak-Florida)
W71-05213

MIDDLESEX WATER CO V BOARD OF PUBLIC UTIL COMM'RS (WATER COMPANY'S DUTY TO MAINTAIN WATER SUPPLY SYSTEM).

140 A 254-256 (NJ 1928).

Descriptors: *New Jersey, *Public utilities, *Water supply, *Water rates, Public utility districts, Water distribution (Applied), Pipelines, Water costs, Costs, Water conveyance, Municipal water, Administrative decisions, Legal aspects, Judicial decisions, Permits, Government finance, Income.

Plaintiff water company sought to reverse an order of defendant public utilities board requiring plaintiff to install certain water mains. Plaintiff contended that the new water lines would not be any more efficient or effective than the old line and that defendant erred in projecting the cost and income so that plaintiff was unable to raise the capital to carry out the order. Affirming defendant's order, the court noted that plaintiff was under a legal duty to maintain an adequate municipal water supply and could not excuse noncompliance with the board's order on the ground of financial inability. Plaintiff had just been granted two rate increases which provided a sufficient return on its capital. (Liptak-Florida)
W71-05217

IN RE WATER FRONT IN TOMPKINSVILLE (APPEAL OF CONDEMNATION AWARDS FOR SUBMERGED LANDS).

249 App Div 382, 220 NYS 18-23 (Sup Ct 1927).

Descriptors: *New York, *Easements, *Condemnation, *Condemnation value, Eminent domain, Compensation, Contracts, Judicial decisions, Legal aspects, State governments, Cities, Permits, Piers, Beds, Beds under water, Access routes.

Appellant municipality condemned respondent's submerged lands. The original condemnation award did not consider appellant's easement in the submerged lands; therefore, appellant sought a lesser award in this appeal. The New York supreme court held that appellant's easement should have been considered in making the award, noting that appellant's easement included right of passage over natural or artificial accretions. Appellant also contended that respondent's land was restricted to construction of public wharves and docks, but this contention was rejected, as was appellant's contention that the condemnation plan itself should affect the award. Covenants providing that respondents would in event of condemnation accept the amount paid to appellant originally, plus the value of any improvements, were held valid and enforceable. The court found that awards for consequential damages and conjunctive use were proper. Although respondents were not engaged in proper activities to obtain a license for shedding the piers, it was held that valuation on the theory that a license could be obtained was proper. Furthermore, the court determined that the ability of vessels to berth on both sides of the dock was properly considered in making the award. (Hart-Florida)
W71-05218

KORROLL V BOARD OF TRUSTEES OF SCHOOL DISTRICT 24 (BOUNDARY DISPUTE UNDER DESCRIPTION EXTENDING TITLE TO BANK OF LAKE).
220 NW 413-414 (Minn 1928).

Descriptors: *Minnesota, *Lakes, *Boundary disputes, *Accretion (Legal aspects), Riparian rights, Boundaries (Property), Real property, Land tenure, Riparian land, Judicial decisions, Legal aspects, Meanders, Land.

Plaintiff riparian landowner sought a declaratory judgment to determine title to a reliction in front of defendant's land. Defendant's deed described his land as extending 'along the bank of the lake.' Plaintiff owned riparian land on both sides of defendant. It was stipulated that the lake was meandered. Plaintiff contended that defendant held title only to the bank, rather than the waterline. Hence it was asserted that defendant had no claim in the reliction. However, the Supreme Court of Minnesota construed defendant's deed to convey title to the waterline and dismissed the action. (Hart-Florida)
W71-05219

EMMONS V UTILITIES POWER CO (CONDEMNATION VALUE OF OVERFLOWED LAND).
141 A 65-70 (NH 1928).

Descriptors: *New Hampshire, *Condemnation value, *Power head, *Flooding, Dams, Hydroelectric plants, Hydroelectric power, Eminent domain, Design flood, Backwater, Riparian land, Rivers, Compensation, Payment, Conjunctive use, Adjudication procedure, Judicial decisions, Legal aspects, Condemnation, Value.

Plaintiff riparian landowner brought action for assessment of damages to land overflowed by the backwater from defendant's dam. Since a 26-ft. power head was created by the river over the length of plaintiff's land, it was especially adaptable for production of water power. Plaintiff contended that the jury should consider conjunctive use of the power head in awarding damages, while defendant asserted that concomitant use should not be a factor in the award. The Supreme Court of Massachusetts stated that: (1) undeveloped water power is a property right inherent in riparian ownership, and therefore compensable; (2) the compensation should equal the diminution in value caused by the flowage; (3) the land should be appraised for its most profitable use; and (4) enhanced value because of conjunctive use may be shown if it would enhance the market price in an arm's length sale. The Supreme Court of New Hampshire held that the lower court erred in refusing to admit evidence of enhanced value caused by conjunctive use. Additionally, it was noted that: (1) special utility may be shown to enhance value; (2) the measure of damages is not the value to condemnor, but the value undeveloped and uncombined with other property; and (3) no rule exists for apportioning values of property capable of development in the aggregate as one unit. (Hart-Florida)
W71-05220

POLITICAL AND INSTITUTIONAL ASPECTS OF THE EVALUATION OF WATER RESOURCES PROGRAMS,
Wisconsin Univ., Madison.
Irving Fox.
In: Evaluation Processes in Water Resources Planning, Urbana, Illinois, American Water Resources Association, p 89-100, July 1970.

Descriptors: *Economic evaluation, Water resource planning, Water law, Decision-making, Cost-benefit analysis, Political constraint, Cost sharing.
Identifiers: *Water institutions, Shoreland management, Social cost, Social benefits.

Water institutions operating in a political context influence the evaluation process for water resources planning, and more specifically the weighting of information bears upon choices among alternative programs. Water institutions are divided into two categories; the laws, policies and programs that influence private enterprise in the water field and the public agencies that formulate water policy and provide water services to the private sector. The example of shoreland management is used to focus attention on private decision-making. A hypothesis is formulated which states that under present laws, shorelands, primarily privately owned, do not serve the public interest since social costs and benefits are not considered in decision-making. The hypothesis is found to be correct with public agencies involved in the environmental degradation of shorelands. The author finds water resource agencies do not represent all sectors of society equitably in policy making with special interest groups receiving the greatest benefits. Possible solutions to the problem include use of multiple alternatives in the evaluation process, greater integration in decision-making and more research on public goals. (Siegenthaler-Rutgers)
W71-05226

IN RE PUBLIC BEACH IN CITY OF NEW YORK (TITLE TO LANDS UNDER WATER).

256 NY 156, 176 NE 5 (1931).

Desriptors: *New York, *Boundaries (Property), *Land tenure, *Ownership of beds, High water mark, Land, Legal aspects, Judicial decisions, Real property, Condemnation, Eminent domain, Damages, Recreation, Cities, Local governments, State governments, Boundary disputes, Oceans, Beaches, Shores, Seashores.

Plaintiff city of New York sought to condemn certain upland property and offshore lands for a public beach. Defendants, by virtue of a colonial grant conveying to 'the main ocean,' claimed ownership of the upland to the high water mark. By virtue of a state conveyance, defendants claimed ownership of the offshore land from the high water mark to a distance of 1200 feet into the ocean. The trial court awarded only nominal damages to plaintiff for lands below high water mark. The appellata court reversed and the Court of Appears of New York affirmed for defendant. The colonial grant to the main ocean conveyed title to the high water mark. The later grant by the state to the land below the high water mark entitled defendant to damages for taking by plaintiff city. (Dye-Florida)
W71-05234

IN RE JAMAICA BAY (COMPENSATION FOR CONDEMNATION OF RIPARIAN RIGHT OF ACCESS).
256 NY 382, 176 NE 539-543 (1931).

Descriptors: *New York, *Riparian rights, *Condemnation, *Access routes, Compensation, Eminent domain, Navigation, Cities, Local governments, Governments, Riparian land, Land, Real property, Legal aspects, Judicial decisions, Navigable waters, Public rights, Relative rights, Docks, Land use, Landfills, Land reclamation, Land forming.

Plaintiff city condemned lands for construction of a marginal street along a bay shore. Defendant landowners sought compensation for destruction of their riparian right of access to the bay. The Court of Appeals of New York reversed in part a judgment denying compensation to defendants. Riparian rights are held subject to the public right to improve navigation and commerce. Riparian owners denied access to the bay by construction of a marginal street for such purposes are not entitled to compensation. However, where plaintiff sought to fill a creek for the purpose of building public streets, compensation must be awarded. In the instant case the city's purpose in condeming and filling some of the property was unclear. If it was

found that part of the fill was intended to be used for public purposes unrelated to navigation, compensation should have been awarded those landowners whose riparian rights were restricted by the fill. (Dye-Florida)
W71-05235

CARR V BANGHART (PRESCRIPTIVE RIGHTS IN STATE LAND).
170 A 620-622 (NJ Ct Err and App 1934).

Descriptors: *New Jersey, *Land tenure, *Canals, *Contracts, Legislation, State governments, Real property, Presciptive rights, Judicial decisions, Legal aspects, Land.

Plaintiff grantee sued defendant grantor for breach of covenant in a general warranty deed. Plaintiff asserted that a portion of the land conveyed by defendant belonged to the state. The disputed portion was part of an abandoned canal. In the legislation authorizing construction of the canal, the state reserved to itself the remainder after a term of years in the canal company. The company abandoned the canal early, but the state's right of possession did not accure until the term's expiration. Defendant, a mere interloper, 'appropriated' the land. Since defendant had not occupied the land for the period of the statute of limitations for adverse possession, running from the time the state's right to possession accrued, the state's title was upheld. Accordingly, the New Jersey Court of Errors and Appeals held defendant liable for breach of covenant. (Hart-Florida)
W71-05237

JENKINS V UNITED STATES (LIABILITY OF UNITED STATES FOR TAKING GRAVEL FROM SAND BAR).
60 Ct C l 23-30 (1924).

Descriptors: *United States, *Mississippi River, *Compensation, *Dredging, Eminent domain, Condemnation, Payment, Administrative agencies, Navigation, Navigable rivers, Rivers, River beds, Sand bars, Banks, Bank erosion, Sands, Gravels, Channels, Channel erosion, Channel improvement, Riparian land, Riparian rights, Bank stabilization, Bank protection, Legal aspects, Judicial decisions.

Plaintiff riparian landowner sued defendant United States to recover the value of sand and gravel removed from an accretion to his land. Defendant had agreed when taking the gravel to make payment if liability attached. The gravel was used for bank protection at an entirely different location. Plaintiff contended that since the removal was not to improve navigability at that location, but solely to obtain the material, defendant must make compensation. Defendant asserted that its right to improve navigation was paramount to plaintiff's riparian ownership. The United States Court of Claims observed that since plaintiff conceded defendant's right to dredge the river to improve navigation without providing compensation, his argument was specious, because the right to compensation should not be determined by the utilization of the dredged material. Holding that plaintiff's ownership to the thread of the stream was subordinate to defendant's authority to improve navigation and that defendant's acts were not a compensable taking, the court dismissed plaintiff's petition. (Hart-Florida)
W71-05249

PREVENTION OF POLLUTION BY OIL AND HAZARDOUS MATERIALS IN MARINE OPERATIONS,
Coast Guard, Washington, D.C. Electrical Engineering Branch.
For primary bibliographic entry see Field 05G.
W71-05326

UNITED KINGDOM OIL INDUSTRY RESEARCH AND PLANS TO DEAL WITH SEA POLLUTION BY OIL,
Esso Petroleum Co. Ltd., London (England).
For primary bibliographic entry see Field 05G.
W71-05334

6F. Nonstructural Alternatives

WISE USE OF FLOOD PLAINS.
New England River Basins Commission, Boston, Mass.

Interim Report, July, 1969. 34 p, 2 fig, 5 tab, 1 chart, 1 append.

Descriptors: *New England, *Flood protection, *Non-structural alternatives, *Flood plain zoning, Flood plains, Flood damage, Flood forecasting, Floodproofing, Floodways, River basin development, Building codes, Flood plain insurance, Regions, Floods, Legislation, Governments, Cities, Urbanization, Community development, Land use, Regulation, Legal aspects.

As a result of increasing flood losses despite substantial flood protection measures, the New England River Basins Commission established a task force to study alternative measures of flood control. This report concentrates on non-structural methods of flood plain management and summarizes existing state and federal programs and policies. The basic problem is the clash between the rivers' natural tendency to flood the plain and the economic pressures to develop these areas. The solution is to prohibit or control this development by zoning and building controls. The report narrates the experience and status of such programs in each of the six New England states. These states have employed a variety of general and special laws, executive orders, local zoning ordinances, building codes, and land acquisition programs. The report also examines progress on 16 recommendations of a federal task force on the problem. The two basic areas of federal activity are assistance in flood plain delineation, surveying, and mapping, and actual assistance programs including a new flood insurance program. Finally, the report reviews the alternatives and assistance available to individual communities in planning and management of their flood plains. The report concludes that a concerted effort to fully use available planning tools is necessary to slow the rate of uneconomic and dangerous development of flood plains and to provide an optimum program for reducing flood losses. (Liptak-Florida)
W71-04994

FLOOD PLAIN INFORMATION OF RAPPAHANNOCK RIVER, FREDERICKSBURG, SPOTSYLVANIA AND STAFFORD COUNTIES, VIRGINIA.
Corps of Engineers, Norfolk, Va.
For primary bibliographic entry see Field 04A.
W71-05071

FLOOD PLAIN INFORMATION OF TOBESOFKEE CREEK, MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W71-05072

FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE,
James E. Goddard.
In: Evaluation Processes in Water Resources Planning, Urbana, Illinois, American Water Resources Association, p 58-74, July 1970.

Descriptors: *Flood plain insurance, Hydrology, Economic evaluation, Risk.
Identifiers: *Flood plain management, Resource planning, Subsidy, Suboptimization, Actuarial rates, Flood plain regulation.

The evaluation of flood plain regulations and possible alternative uses of flood plans based on site advantages is discussed. There are three general approaches to dealing with the flood plain; namely flood protection, flood plain regulations and resource planning. The resource planning approach is involved with community goals and management opportunities and avoids problems of suboptimization. The Federally-assisted flood insurance program is described along with the land use and control measures. The author suggests refinements in Federal Flood Insurance to allow true risk rates. Flood loss reimbursement rates offer a high subsidy for houses at low elevations but neglect commercial activities in the same area. The subsidy makes economic evaluation of the flood insurance program difficult since benefits and costs accrue to different parties. The author concludes that flood insurance is effective but offers little prospect for reform. (Siegenthaler-Rutgers)
W71-05223

PROBLEMS IN DEVELOPING A NATIONAL FLOOD-PROTECTION POLICY,
American Water Works Association, New York.
For primary bibliographic entry see Field 04A.
W71-05228

6G. Ecologic Impact of Water Development

MAN AND HIS ENVIRONMENT, VOLUME 1.
Calgary Univ. (Alberta).
For primary bibliographic entry see Field 05G.
W71-04901

FEDERAL PROTECTION OF ENDANGERED WILDLIFE SPECIES,
For primary bibliographic entry see Field 06E.
W71-04982

THERMAL EFFECTS STUDIES FOR PALISADES NUCLEAR PLANT,
Consumers Power Co., Jackson, Mich.
For primary bibliographic entry see Field 05C.
W71-05137

COUNCIL ON ENVIRONMENTAL QUALITY STATEMENTS ON PROPOSED FEDERAL ACTION AFFECTING THE ENVIRONMENT.
For primary bibliographic entry see Field 06E.
W71-05180

THE QUALITY OF THE URBAN ENVIRONMENT,
California Univ., Los Angeles.
Harvey Perloff.
Baltimore, Johns Hopkins Press, 1969. 332 p.

Descriptors: *Urban environment, Pollution, Decision-making, Urban planning, Rent, Water resource development, Natural resources.
Identifiers: Material balance, Externalities, Congestion transport facilities.

The results of a conference on the Urban Environment held in 1967 are presented. The objective of the conference was to evaluate the existing information sources and new information that would be needed for measurement of environmental change and to study public policy issues related to environmental improvements. The main purpose was to present concepts useful to scholars and policy makers. The papers report on research in progress and are, therefore, essentially progress reports. The first paper attempts to set up a decision-making framework for policy making on the urban environment. The papers on pollution demonstrate the interrelation between waste product and the urban environment. Other papers deal with urban space on a two and three dimensional basis. This book is relevant for water resource planners concerned with the impact of government water investment

xpenditures on the urban environment. Siegenthaler-Rutgers)
V71-05214

OCIAL SCIENCES AND THE ENVIRONMENT, Colorado Univ., Boulder, and Environmental cience Services Administration, Washington, .C.
or primary bibliographic entry see Field 06B.
V71-05245

CONOMICS AND THE QUALITY OF THE EN-IRONMENT, SOME EMPIRICAL EX-ERIENCES,
esources for the Future, Washington, D.C.
or primary bibliographic entry see Field 06B.
V71-05246

7. RESOURCES DATA

A. Network Design

ATIONAL AND INTERNATIONAL ENVIRON-ENTAL MONITORING ACTIVITIES--A IRECTORY.
nithsonian Institution, Cambridge, Mass., Center r Short-Lived Phenomena.

or sale by Smithsonian Institution Center for ort-Lived Phenomena, 60 Garden Street, Cam-idge, Mass. 02138 - Price $10.00. Smithsonian stitution Center for Short-Lived Phenomena, Oc-ber 1970. 292 p.

escriptors: *Environment, *Data collections, Monitoring, *Networks, *Surveys, Meteorologi-l data, Climatic data, Data transmission, Interna-onal Hydrological Decade, Stations, Tsunamis, ydrologic data, Weather data, Pesticides, Path of llutants, Earthquakes, Radioactivity, Solar radia-on, Hurricanes, Typhoons, Seismic studies, Fal-ut.
entifiers: *Monitoring (Environmental), *Short-ed phenomena.

1968 the Smithsonian Institution utilized the chniques of modern communications to establish world-wide monitoring system for short-lived tural events demanding immediate scientific in-stigation, such as volcanoes, earthquakes, eteorite falls and massive biological changes. oday, the Smithsonian Center for Short-Lived enomena has more than 2200 scientific cor-spondents in 129 countries and serves as the rld's clearinghouse and repository for informa-n concerning sudden, unpredictable, and short-ed events. The purpose of this directory is to esent, in one unified format, basic information on e number, global distribution, and operational aracteristics of existing and planned environ-ental monitoring activities. Questionnaires were nt to all known organizations and individuals en-ged in environmental research, natural resource nagement, and pollution control on an interna-nal or national scale. A total of 2,332 organiza-ns and individuals in 153 countries received estionnaires. (Knapp-USGS)
71-05115

B. Data Acquisition

IL MOISTURE DETECTION WITH IMAG-G RADARS,
nsas Univ., Lawrence. Remote Sensing Lab.
rold C. MacDonald, and William P. Waite.
ater Resources Research, Vol 7, No 1, p 100-0, February 1971. 11 p, 7 fig, 22 ref. Contract AK02-68-C-0089 (THEMIS, Dept. ARMY); ASA Contract NAS9-10261.

scriptors: *Soil moisture, *Remote sensing, adar, *Mapping, Surveys, Soil water, Soil clas-cations, Soil investigations, Soil physical proper-ties, Soil types, Vegetation effects, Arctic, Per-mafrost.
Identifiers: *Radar (Imaging), *Radar (Side-looking).

The effects of soil moisture are extremely difficult to separate from other terrain parameters influencing the radar return signal. Presently available dual polarized, K-band, side-looking imaging radars provide a capability for revealing a qualitative estimate of soil moisture content. When used as a supplement to aerial photography in temperate climates, radar imagery analysis can provide data for mapping regions of permafrost, and this process caould be accomplished regardless of weather or time of day. (Knapp-USGS)
W71-04857

FLOW CELL SYSTEM FOR MISCIBLE DISPLACEMENT EXPERIMENTS,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 02G.
W71-04868

SINGLE-WELL TECHNIQUE USING P-32 FOR DETERMINING DIRECTION AND VELOCITY OF GROUNDWATER FLOW,
Middle Eastern Regional Radioisotope Center for the Arab Countries, Cairo, United Arab Republic.
For primary bibliographic entry see Field 02F.
W71-04878

A NEW METHOD OF DETECTING LEAKS IN RESERVOIRS OR CANALS USING LABELLED BITUMEN EMULSIONS (FRENCH),
CEA, Center of Nuclear Study of Grenoble, and Societe routiere Colas, Paris, France.
For primary bibliographic entry see Field 04A.
W71-04879

METHOD OF DETERMINING LEAKAGE VELOCITIES THROUGH THE BOTTOM OF RESERVOIRS,
Institute of Nuclear Physics, Cracow, Poland.
For primary bibliographic entry see Field 04A.
W71-04880

MODEL OF HYDROLOGIC REDISTRIBUTION OF RADIONUCLIDES AROUND NUCLEAR-EXCAVATED SEA-LEVEL CANALS,
Isotopes, Inc., Palo Alto, Calif. Palo Alto Labs.
For primary bibliographic entry see Field 05B.
W71-04882

CONTRIBUTION TO THE SELECTION OF RADIOACTIVE TRACERS FOR HYDROGEOLOGY (FRENCH),
Bureau of Geological and Mining Research (BRGM), Paris, France, and Commission of European Communities, Brussels, Belgium.
Andre Lallemand, and G. Grison.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/52, p 823-833, 1970. 11 p, 7 tab.

Descriptors: *Tracers, *Radioistopes, *Hydrogeology, Groundwater movement, Cesium, Tritium, Phosphorus radioisotopes, Carbon radioisotopes, Iodine radioisotopes, Clay minerals, Water chemistry, Water quality, Sea water, Spring waters, Sands.
Identifiers: Chromium radioisotopes, Iron radioisotopes, Calcium radioisotopes, Silver radioisotopes, Sodium radioisotopes, Cesium radioisotopes, Sulfur radioisotopes, Bromine radioisotopes.

A systematic study was made of a number of anionic and cationic tracers in different terrains with distinct petrographic characteristics, allowance being made for the various physical and chemical parameters of the environment. The behavior of 12 tracers (Cr-51, Fe-59, Ca-45, Ag-110, Na-24, Cs-137, H-3, P-32, S-35, C-14, I-131, Br-82) was studied in six types of argillaceous rock (illite, vermiculite, interstratified illite-vermiculite, montmorillonite, attapulgite and kaolinite) and three sand types (siliceous, Calcareous and dolomitic) in the presence of three types of water (demineralized, sea-water and various spring waters). On the basis of the results obtained from 5000 tests and measurements made during this study, selection tables are given for using the tracer most suited to the characteristics of the terrain and the type of groundwater. (Knapp-USGS)
W71-04883

RADON IN GROUNDWATERS OF DOLOMITIC AND CALCAREOUS AQUIFER IN APULIA (SOUTHERN ITALY),
CNEN, Laboratory for the Application of Radioisotopes to Hydrogeology, Bari, and Bari Univ., Italy.
For primary bibliographic entry see Field 02K.
W71-04884

SILICON-32 HYDROLOGY,
Tata Inst. of Fundamental Research, Bombay, India.
For primary bibliographic entry see Field 02K.
W71-04885

USE OF RARE-EARTH ELEMENTS AS TRACERS IN ESTUARIES,
Stanford Univ., Calif.
For primary bibliographic entry see Field 02L.
W71-04886

HYDROLOGIC AND PHOTOGEOLOGIC DETERMINATION OF RAINFALL, RUNOFF, AND GROUNDWATER RELATIONSHIPS IN A DOLOMITE AREA,
Missouri Water Resources Research Center, Rolla; and Missouri Water Resources Research Inst., Rolla.
For primary bibliographic entry see Field 02A.
W71-04937

EVAPORATION LOSSES IN SPRINKLER IRRIGATION,
Florida Univ., Gainesville. Dept. of Agricultural Engineering; and Florida Univ., Gainsville. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-04938

PASSIVE MICROWAVE MEASUREMENTS OF SNOW, SOILS, AND OCEANOGRAPHIC PHENOMENA,
Aerojet-General Corp., El Monte, Calif. Space Div.
A. T. Edgerton, D. T. Trexler, G. A. Poe, A. Strogryn, and S. Sakamoto.
Available from NTIS as AD-714 855, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 6, Feb 1970. 177 p, 94 fig. ONR NR 387-033.
Identifiers: *Snow, *Microwave spectroscopy, *Soils, Microwave spectroscopy, *Ocean waves, Microwaves Emissivity, Response Beaches, Sand, Surface roughness, Temperature, Brightness, Sedimentation, Sea ice, Salinity, Tables, Mathematical models, *Microwave radiometry, Littoral zones, Snowpack, Surf, Sea states, *Remote sensing.

Research consisted of a combination of field and laboratory investigations of the microwave emission characteristics of natural materials, and analytical modeling of the microwave radiation characteristics of selected materials to establish a better understanding of the physics of microwave emission. Field and laboratory investigations dealt with sediments, snow, ice, water and the coastal environment. Measurements were taken at observational wavelengths of 0.81 and 2.2 cm. Measurements of the littoral zone were taken to establish

the microwave emission characteristics of breakers, foaming water, spray, the swash zone, etc. High emissivities associated with foaming water in the surf zone prompted a laboratory experiment where foam was artificially generated and the microwave response monitored at 0.81 and 2.2 cm wavelengths as a function of percent of surface foam coverage. The results indicate that radiometric temperature depends strongly on the percentage of foam coverage and suggests that analytical models for predicting brightness temperatures of the open ocean must consider the percentage of surface covered by white caps. Laboratory measurements of the microwave response at 0.81 and 2.2 cm of fresh and sea water as a function of thermometric temperature show good agreement with emissivity values computed by investigators at Texas A and M University. The microwave emission characteristics of fresh and sea ice as a function if ice growth were investigated in the laboratory. Distinct differences in the response of fresh ice and sea ice are apparent during initial ice growth. Further measurements at longer wavelengths are indicated to fully evaluate the potential of microwave radiometry for distinguishing sea ice types. Additional research concerning emission characteristics of sediments was accomplished. This work was concerned with the relationship between moisture content and microwave emission. Experiments were conducted for two types of sediments. A beach sand water table fluctuation experiment was also performed.
W71-04942

THE MEASUREMENT OF WATER DEPTH BY REMOTE SENSING TECHNIQUES,
Michigan Univ., Ann Arbor. Inst. of Science and Technology.
F. C. Polcyn, W. L. Brown, and I. J. Sattinger.
Report No 8973-16-F, Oct 70. 48 p, 14 fig, 6 tab, 5 ref. ONR Contract No N62306-67-C-o243.
Identifiers: *Shallow water, Depth indicators, *Aerial photography, Sensors, Water waves, Refraction, Spacecraft cameras, Integral transforms, Programming (Computers), Digital computers, Data processing systems, Magnetic tape, Wave analyzers, Optical equipment, Lasers, Analysis of variance, Great Lakes, *Remote sensing Computer graphics, Fourier transformation, Lake Michigan.

The study demonstrates successful remote determination of shallow water depth by measuring wave refraction changes and using the Fourier transform plane for wavelength measurements with data obtained at a Lake Michigan test site. The study shows that the technique is suitable for use from spacecraft altitudes, provided that water waves of suitable length occur in the region of interest.
W71-04946

RESEARCH IN THE COASTAL AND OCEANIC ENVIRONMENT,
Delaware Univ., Newark.
For primary bibliographic entry see Field 02L.
W71-04950

PRIORITY PROBLEMS AND DATA NEEDS IN COASTAL ZONE OCEANOGRAPHY. EARTH OBSERVATION SATELLITE PLANNING,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02L.
W71-04952

AUTOMATED METHOD FOR DETERMINING AND REMOVING SILICA INTERFERENCE IN DETERMINATION OF SOLUBLE PHOSPHORUS IN LAKE AND STREAM WATERS,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-04962

SPECIFIC CONDUCTANCE AS A MEANS OF ESTIMATING IONIC STRENGTH,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
W71-04975

VERTICAL MOLECULAR DIFFUSION OF XENON-133 GAS AFTER INJECTION UNDERGROUND,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 05B.
W71-04977

RETENTION TIME AND CIRCULATION STUDY IN A SEWAGE STABILIZATION LAGOON,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 05D.
W71-04978

ANOMOLY PATTERNS OF CLIMATE OVER THE WESTERN UNITED STATES, 1700-1930, DERIVED FROM PRINCIPAL COMPONENT ANALYSIS OF TREE-RING DATA,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02B.
W71-05063

REMOTE SENSING OF HYDROLOGIC RESOURCES IN THE GREAT PLAINS, REPORT 1,
South Dakota State Univ., Brookings. Remote Sensing Inst.
F. A. Waltz, and V. I. Myers.
Available from NTIS as PB-195 451, $3.00 in paper copy, $0.95 in microfiche. Geological Survey Interagency Report USGS-202, June 1970. 60 p, 20 fig, 12 graph, 28 tab, 1 ref, 4 append. USGS Grant 14-08-0001-G-25.

Descriptors: *Remote sensing, *Satellites (Artificial), *Soil moisture, *Soil-water-plant relationships, Data processing, Data transmission, Photography, Soil properties, Infrared radiation, Statistical methods, Soil moisture meters, Microclimatology.
Identifiers: Soil moisture surveys.

A data handling system is proposed for measuring and disseminating cropland soil moisture information from ERTS spacecraft. Large significant correlations were found between optical density measured on aerial film and soil water content measured by neutron probe methods, and between ground temperatures as measured through infrared thermal scanner techniques and soil water content of fallow or bare soil. Least square analyses of variance indicated crop types, time, and the interaction of crops as highly significant sources of variation. Pattern recognition of different crops is possible using densitometry measurements if the extraneous variation can be controlled, measured, or removed. Soil water content, plant water content, and available soil water must be measured. (Knapp-USGS)
W71-05091

ON THE MICROSCOPIC DETERMINATION OF THE VOLUME SIZE DISTRIBUTION OF FINE-GRAINED SUSPENDED PARTICLES,
Johns Hopkins Univ., Baltimore, Md., Chesapeake Bay Inst.
J. R. Schubel, and E. W. Schiemer.
Limnology and Oceanography, Vol 14, No 3, p 438-441, May 1969. 4 p, 3 fig, 1 tab, 4 ref. Bureau of Commercial Fisheries Project 3-30-R.

Descriptors: *Filters, *Sieve analysis, *Particle size, *Suspended load, *Screens, Filtration, Silts, Plankton, Suspension, Sedimentology.
Identifiers: *Particle size analysis.

A multipass filtering apparatus costs less than $40.00, and it can be built in less than two days. The apparatus is loaded with a series of screens different mesh size through which a measu volume of water is passed. Suitable screen material is available in mesh sizes ranging from microns to more than 1,500 microns. Disks (mm) can be cut from the cloth easily. The series mesh sizes most useful for analyzing the suspend particles of the Chesapeake Bay is 102, 53, 25, 20 microns. Each of these screens is supported b disk of 1,558 micron mesh cloth. In addition to use to increase the precision of volume s statistics obtained from number size distributio the multipass filtering apparatus is useful for fr tionating samples of plankton. (Knapp-USGS)
W71-05107

NATIONAL AND INTERNATIONAL ENVIRO MENTAL MONITORING ACTIVITIES DIRECTORY.
Smithsonian Institution, Cambridge, Mass., Cen for Short-Lived Phenomena.
For primary bibliographic entry see Field 07A.
W71-05115

AIRBORNE TEMPERATURE SURVEYS LAKE MICHIGAN, OCTOBER, 1966 AND 196
Michigan Univ., Ann Arbor. Great Lakes Resear Div; and Naval Oceanographic Office, Washingt D.C.
V. E. Noble, and J. C. Wilkerson.
Limnology and Oceanography, Vol 15, No March 1970, p 289-296. 7 fig, 6 ref.

Descriptors: *Lake Michigan, Isotherms, Infrar radiation, *Remote sensing, *Temperature, Lak *Water temperature.
Identifiers: *Airborne temperature surveys, *Th mal gradient, Satellite data.

Low-altitude flights to map surface water tempe ture were carried out over Lake Michigan on October 1966 and 25 October 1967. During t 1966 flight, a strong surface water thermal gradie (4.4C/6,000 m) was observed. This gradient w accompanied by a distinct color change. Dynam height currents computed from a bathytherm graph transect through the gradient indicated northward current of the order of 10-12 cm/sec the gradient zone. The thermal structure persist for a week. A similar temperature gradient-col separation-dynamic height current feature was o served during 1967. Data from Nimbus meteorological satellite for 7 September and 6 O tober 1966 show a large, weak structure in t radiation temperature patterns that might be i terpreted as precursors of the temperature-curre structure. This thermal structure might be a recu ring seasonal characteristic of Lake Michigan. (padhyaya-Vanderbilt)
W71-05120

GREAT LAKES THERMAL STUDIES USIN INFRARED IMAGERY,
Department of Energy, Mines and Resource Burlington (Ontario). Canada Center for Inlan Waters.
R. K. Lane.
Limnology and Oceanography, Vol 15, No March, 1970, p 296-300. 5 fig, 2 ref.

Descriptors: *Temperature, *Lake Ontario, Gre Lakes, Infrared radiation, *Remote sensing, Lake Identifiers: *Thermal studies, Infrared imager Thermal bar, Airborne thermometry.

During spring to autumn, 1968, seven airborne su veys of western Lake Ontario were made with a infrared scanner. The sensor of the infrare scanner repeatedly scans a path normal to fligh across a 120 deg field of view detecting elec tromagnetic radiation in the 8-14 micron ban Spatial resolution is 16 m radians and therma resolution is estimated at 0.01C. Examples o mosaics of infrared imagery of the western end o Lake Ontario are used to demonstrate their valu in revealing detailed surface thermal patterns. Ad

itional data from airborne thermometry and ship-oard measurements confirm the interpretation of rge scale dynamic processes. Smaller scale nenomena such as internal wave patterns and nall eddies, are also interpretable. The problem of ealing with the attenuation effects of the at-osphere is more difficult, particularly since the anner views through a path length that changes a factor of 2 as it sweeps from nadir to 60 deg. ne use of atmospheric profile data, the air-water mperature difference, and a narrower band de-ctor offers the possibility for more quantitative ta. (Upadhyaya-Vanderbilt)
71-05123

OOD PLAIN DELINEATION WITH PAN AND OLOR,
isconsin Univ., Madison. Department of Soil ience.
le E. Parker, Gerhard B. Lee, and Clarence J. lfred.
print, Photogrammetric Engineering, p 1059-63, October 1970. 3 fig, 7 ref. OWRR B-002-IS (12).

scriptors: *Flood plains, Color, *Aerial photog-hy, Glaciation, Cross-sections, *Hydrologic a, Wisconsin, Photogrammetry, *Boundaries rfaces), Photography.
ntifiers: Delineation, Panchromatic photog-hy, Physiographic landforms, Southern Wiscon-, Flood plain boundaries.

undaries of rare floods, such as a 100-year recur-nce interval flood which is widely used for nning and regulatory purposes, are ordinarily tted by engineering procedures. In this study od plain boundaries were interpreted on nchromatic, and color aerial photographs along ream in a glaciated area of southern Wisconsin. e accuracy of these boundaries was determined comparison at 29 cross sections with those of an ermediate Regional Flood plotted by the U. S. ny Corps of Engineers. Boundaries on both es of photography agreed with the engineering ndary at 28 percent of the cross sections, were hin 100 feet at 67 percent of the cross sections, within 300 feet at 95 percent of the cross sec-s. Flood plain boundaries were most accurately neated where physiographic landforms were l defined. The results indicate that airphoto in-retation can be a useful tool to delineate flood n boundaries where the lack of hydrologic data, e, and funds prohibit plotting boundaries by litional engineering methods. (Parker-Wiscon-

1-05145

DROLOGIC INTERPRETATION OF NIM-S VIDICON IMAGE - GREAT SALT LAKE, AH,
logical Survey, Washington, D.C.
C. Hahl, and A. H. Handy.
ilable from NTIS as N70-38843, $3.00 in paper y, $0.95 in microfiche. Technical Letter SA-61, Nov 1966. 3 p. NASA Contract R-09-015.
ntifiers: *Hydrology, *Nimbus satellites, otointerpretation, *Satellite television, Utah, icons.

analysis was made to determine if features of rologic significance were visible and identifia-The features that are pointed out on an an-ted copy of the image indicate some of the fac-that are required to produce an image. Vegeta-and geology may be responsible for the neation or lack of delineation of some features. th is not considered a factor in producing an ge. The implications of using the Advanced con Camera System in the field of hydrology assessed.
1-05152

APPLICATION OF METHOD FOR PREDICTING THERMAL ERROR IN MEASUREMENT OF GROUND TEMPERATURE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02C.
W71-05257

PHOTOGRAPHIC EVALUATION OF WATER WELLS,
Layne Texas Co., Inc., Houston.
Owen F. Jensen, Jr., and William Ray.
Reprint, Presented at the SW Section of AWWA 53rd Annual Conference, 1964. 20 p.

Descriptors: *Water well, *Wells, Casing, Photography, Remote sensing.
Identifiers: *Downhole photographs, Well condition evaluation, New well completions, Damaged wells, Junk in wells, Formation identification.

Photographs of wells in stereoscopic, three dimensional pairs, are used for evaluation of well conditions. The pictures provide accurate detail pictures from which determination can be made for remedial procedures or for inspection of a well from top to bottom. These stereoscopic photograph surveys are used for evaluation of new well completions, damaged well, junk in wells, and formation material identification. Incorporated in this paper are pictures of the groups made in wells. (Campbell-NWWA)
W71-05299

7C. Evaluation, Processing and Publication

NUMERICAL SIMULATION OF FLOOD WAVE MODIFICATION DUE TO BANK STORAGE EFFECTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W71-04854

A COMPARATIVE STUDY OF CRITICAL DROUGHT SIMULATION,
California Univ., Los Angeles. Dept. of Engineering Systems.
For primary bibliographic entry see Field 04A.
W71-04861

A SIMULATION MODEL OF A COMPLEX RECURVED SPIT,
Nottingham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W71-04870

COMPARISON OF HYDROLOGICAL AND MATHEMATICAL METHODS IN ANALYSIS OF TRITIUM DATA,
Federal Experimental and Research Institute Arsenal, Vienna, and Technical High School, Vienna, Austria.
R. Konig, and J. Reitinger.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/50, p 787-800, 1970. 14 p, 4 fig, 8 ref.

Descriptors: *Sampling, *Tritium, Tracers, Hydrogeology, Statistical methods, Optimization, Groundwater movement, Water yield, Springs, Discharge (Water), Water balance, Water resources, Water resources development, Groundwater basins.
Identifiers: *Vienna (Austria).

Many tritium samples were recently taken in boreholes, springs and groundwater overflows in the southern Vienna Basin, Austria. The data were analyzed to determine whether the tritium data confirm existing hydrological models, whether the tritium data give new information about the hydrology of this region, and the proper number of samples and frequency of sampling. These questions are treated using statistical mathematical methods. The measured time series (isotopic data) are random samples. Statistical methods give optimum values for the time interval for sampling and the total time of sampling. (Knapp-USGS)
W71-04881

A COMPUTER-ORIENTED GENERALIZED POROSITY-LITHOLOGY INTERPRETATION OF NEUTRON, DENSITY AND SONIC LOGS,
Gulf Research and Development Co., Pittsburgh, Pa.
Martin H. Harris, and R. B. McCammon.
Journal of Petroleum Technology, p 239-248, February 1971. 10 p, 6 fig, 4 tab, 9 ref.

Descriptors: *Radioactive well logging, *Data processing, *Borehole geophysics, Stratigraphy, Porosity, Permeability, Density, Computers, Computer programs, Subsurface investigations.
Identifiers: *Sonic well logging, *Well log interpretation.

The linear bulk volume response equations for neutron, density and sonic logs are formulated to simultaneously determine porosity and lithology in sand-shale as well as carbonate lithologies. A fundamental problem in solving the response equations, that of the existence of nonunique solutions, is resolved. Nonunique solutions arise because the number of lithology and porosity terms that must be considered exceeds the number of response equations. The validity of the generalized equations and the minimum variance technique for resolving nonunique solutions is illustrated. (Knapp-USGS)
W71-04889

FLOOD HAZARD INFORMATION, ROSE CANYON AND SAN CLEMENTE CANYON, CITY OF SAN DIEGO, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W71-04904

FLOOD PLAIN INFORMATION, HATCHIE RIVER, PLEASANT RUN CREEK AND SPRING CREEK, BOLIVAR, TENNESSEE.
Corps of Engineers, Memphis, Tenn.
For primary bibliographic entry see Field 04A.
W71-04905

PROGRAM OF THE WATER RESOURCES DIVISION, TEXAS DISTRICT, FOR THE 1971 FISCAL YEAR AND SUMMARY OF DISTRICT ACTIVITIES DURING FISCAL YEAR 1970.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Information Bulletin, December 1970. 34 p, 1 map.

Descriptors: *Water resources, *Programs, *Project planning, *Reviews, *Texas, Surface water, Groundwater, Publications, Bibliographies, Hydrologic data, Streamflow, Runoff, Water yield, Gaging stations, Lakes, Reservoirs, Geology, Data collections, Projects, Project purposes, Aquifers, Water levels.
Identifiers: *Hydrologic data summary (1970 FY Tex), *Data collection plans (1971 FY Tex).

The program of the Water Resources Division in Texas consists of the collection of basic records through the hydrologic-data network, interpretive studies, and research. The basic-data records and the results of investigations are published by the Geological Survey or by cooperating agencies. This report summarizes the scheduled activities of the Water Resources Division in Texas for the fiscal year (July 1, 1970 to Jun 30, 1971) and district activities during fiscal year 1970 (July 1, 1969 to

June 30, 1970). A significant activity in the Texas District is the collection of basic hydrologic data. Continuing series of measurements are made of streamflow, reservoir contents, chemical quality of water, sediment in streams and reservoirs, water levels in wells, and land-surface subsidence. Modern computer techniques are being used successfully in the collection and publication of water data. By the end of the 1971 fiscal year, the following installations will be in operation: Approximately 220 digital recorders at stream-gaging stations; 20 conductivity recorders; and one instrument for continuously and simultaneously monitoring and recording the water-quality characteristics of conductivity, water temperature, dissolved oxygen and pH. The use of electronic data processing for printing and storing water records will be expanded. (Woodard-USGS)
W71-04906

MATHEMATICAL MANAGEMENT MODEL--UNCONFINED AQUIFER,
Texas Tech Univ., Lubbock. Water Resources Center; and High Plains Underground Water Conservation District No. 1, Lubbock, Tex.
For primary bibliographic entry see Field 02F.
W71-04931

EVALUATION OF THE STREAMFLOW DATA PROGRAM FOR ARKANSAS,
Geological Survey, Little Rock, Ark.
James L. Patterson.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.75. Geological Survey Research 1970, Chapter D, Professional Paper 700-D, p D244-D256, 1970. 13 p, 1 fig, 5 tab, 8 ref.

Descriptors: *Data collections, *Streamflow, *Arkansas, *Hydrologic data, Streamflow forecasting, Peak discharge, Low flow, Floods, Stage-discharge relations, Stream gages, Gaging stations, Networks, Hydrology, Sedimentation, Planning, Evaluation, Discharge (Water).
Identifiers: Streamflow data.

An evaluation of the streamflow data available in Arkansas was made to provide guidelines for planning. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program in quantitative form, (2) examination and analysis of available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the objectives. Since many of the goals could be met by generalization of the data for gaged basins by regression analysis, significant changes could be made in the data program that would allow emphasis to be placed on attaining the goals that have not been met. A streamflow data program based on the guidelines developed in this study is proposed. (Knapp-USGS)
W71-04974

WATER RESOURCES OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK, TENNESSEE AND NORTH CAROLINA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-04979

FLOOD OF MARCH 1968 ON THE SUDBURY, ASSABET, AND CONCORD RIVERS, MASSACHUSETTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-04980

FLOOD OF JUNE 1967 AT GRAND ISLAND, NEBRASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-04981

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1969,
Geological Survey, Austin, Tex. Water Resources Div.
H. D. Buckner.
Geological Survey Report, January 1971. 9 p, 1 fig.

Descriptors: *Streamflow, *Flow measurement, *Data collections, *Gaging stations, *Reservoir stages, Texas, Surface waters, Hydrologic data, Flow rates, Average flow, Low flow, Peak discharge, Lakes.
Identifiers: *Trinity River basin (Tex), Basic data, Flow extremes.

Streamflow data for 3 gaging stations and reservoir contents for one lake in the Trinity River basin, Texas, are tabulated for the 1969 water year (October 1, 1968 to September 30, 1969). The stations include Mountain Creek near Cedar Hill, Walnut Creek near Mansfield, Mountain Creek at Grand Prairie and Mountain Creek Lake near Grand Prairie. Pertinent information concerning historic and current hydrologic data are included in the table headings. Basin outflow for the 1969 water year was 145,400 acre-feet. Storage in Mountain Creek Lake showed a net increase of 2,850 acre-feet during the water year. Rainfall over the study area for the 1969 water year was about 33 inches, which is about 1 inch below the long-term mean for the area. (Woodard-USGS)
W71-05049

MASS, MOMENTUM, AND ENERGY BUDGET EQUATIONS FOR BOMAP COMPUTATIONS,
National Oceanic and Atmospheric Administration, Rockville, Md., The BOMAP Office.
For primary bibliographic entry see Field 02A.
W71-05052

RECORDS OF WATER-LEVEL MEASUREMENTS IN WELLS IN GALVESTON COUNTY, TEXAS, 1894-1969.
Geological Survey, Houston, Tex.

Published and distributed by the Texas Water Development Board, P O Box 13087 Austin, Tex 78711. R. K. Gabrysch, Gene D. McAdoo, and C. W. Bonnet, compilers. Texas Water Development Board Report 123, December 1970. 100 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Water levels, *Groundwater, *Observation wells, *Data collections, Texas, Hydrologic data, Water level fluctuations, Aquifers, Wells, Depth.
Identifiers: *Galveston County (Tex).

Measurements in most observation wells in Galveston County, Texas, are made annually, but some measurements are made monthly, quarterly, or semiannually. A continuous measurement record is obtained at two locations where water-stage recorders are installed. If numerous measurements in a well were made during a short period of time, or if water-level data were obtained from a water-stage recorder, representative water levels were selected for publication. Water levels are referenced to land-surface datum. (Woodard-USGS)
W71-05069

RECORDS OF WATER-LEVEL MEASUREMENTS IN WELLS IN HARRIS COUNTY, TEXAS, 1966-1969.
Geological Survey, Houston, Tex.

Published and Distributed by the Texas Water Development Board, P O Box 13087, Austin, Tex 78711. R. K. Gabrysch, C. W. Bonnet, and W. L. Naftel, compilers. Texas Water Development Board Report 122, November 1970. 65 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Water levels, *Groundwater, *Observation wells, *Data collections, *Texas, Hydrologic data, Water level fluctuations, Aquifers, Wells, Depth.
Identifiers: *Harris County (Tex).

This report is the second in a series of repor prepared by the U. S. Geological Survey cooperation with the Texas Water Developme Board and the city of Houston on water-level me surements in Harris County, Texas. Measuremen in most observation wells are made annually, b some measurements are made monthly, quarterl or semiannually. A continuous measureme record is obtained at five locations where wate stage recorders are installed. If numerous measur ments were obtained from a water-stage recorde representative water levels were selected for publ cation. (Woodard-USGS)
W71-05070

QUALITY OF SURFACE WATERS OF TH UNITED STATES, 1965, PARTS 12-16.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, U.S Government Printing Office, Wash, D.C. Price $2.00. Geological Survey Water-Supply Pape 1966; 1970. 462 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Surface water *Data collections, *Water analysis, *Pacifi Northwest U.S., Alaska, Hawaii, Sediment tran port, Sediment yield, Sediment load, Particle size Water temperature, Water properties, Wate chemistry, Chemical analysis.
Identifiers: *Basic data (Surface-water quality).

This volume includes data on quality of surfac waters in Northwestern conterminous Unite States, Alaska, and Hawaii for the 1965 water yea (October 1, 1964 to September 30, 1965). Th Geological Survey maintained 206 stations on 15 streams. Samples were collected daily and monthl at 67 of these locations for chemical-quality stu dies. Samples also were collected less frequently a many other points. Water temperatures were mea sured continuously at 126 and daily at 36 stations Quantities of suspended sediment are reported fo 35 stations from samples collected one or mor times daily. Particle-size distributions of sediment were determined at 41 stations. Descriptive state ments are given for each sampling station includin location of the station, drainage area, periods o records available, extremes of dissolved solids hardness, specific conductance, temperature, sedi ment loads, and other pertinent data. Records o discharge of the streams at or near the samplin station are included in most tables of analyses (Woodard-USGS)
W71-05089

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA - VOLUME I.
Geological Survey, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Wash, D.C. 20402 - Price $2.75. Geological Survey Water-Supply Paper 1928, 1970. 501 p, 3 fig, 1 plate.

Descriptors: *Surface waters, *Flow measurement *Hydrologic data, *Gaging stations, *California, Data collections, Streamflow, Lakes, Reservoir stages, Runoff, Discharge measurement, Average flow, Low flow, Peak discharge.
Identifiers: *Pacific slope basins (Calif).

This volume which contains hydrologic data of basins from Tia Juana River to Santa Maria River in California, is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs, a description of the

tation and a monthly summary table of stage and ontents are given. Data for partial-record stations nclude discharge measurements at low-flow par-ial-record stations, and annual maximum stage and ischarge at crest-stage stations. (Woodard-USGS)
V71-05090

LECTRICAL-ANALOG-MODEL STUDY OF VATER RESOURCES OF THE COLUMBUS REA, BARTHOLOMEW COUNTY, INDIANA,
eological Survey, Washington, D.C.
or primary bibliographic entry see Field 02F.
/71-05092

HE STREAMFLOW DATA PROGRAM IN OWA - EVALUATION OF THE PAST, ROPOSAL FOR THE FUTURE,
eological Survey, Iowa City, Iowa.
an L. Burmeister.
eological Survey Open-file Report, 1970. 82 p, 10 g, 8 tab, 15 ref, append.

escriptors: *Streamflow, *Hydrologic data, *Pro-ams, *Project planning, *Iowa, Water resources, rface waters, Gaging stations, Stream gages, ata collections, Discharge measurement, Flow haracteristics, Average flow, Frequency analysis, recipitation (Atmospheric), Runoff, Flow rates, egression analysis, Network design, History, atural flow, Regulated flow, Streams, Tempera-re.
entifiers: *Streamflow data (Iowa).

he streamflow data program in Iowa was evalu-ed on the basis of past records and present goals d needs. Many of the goals could be met by neralization of the data for gaged basins by gression analysis. Estimates of mean annual and onthly discharges, flood-volume and peak scharges of 5-year frequency or greater can be ade within the accuracy equivalent to 10 years of cord. Mean annual and 7-day 50-year flood lume discharges can be estimated within the ac-racy equivalent of 25 years of record. Significant anges could be made in the present data program at would allow emphasis to be placed on attaining e goals that have not been met. Contingent upon tual agreement with cooperating agencies, the wa District proposes discontinuing 33 of the 119 ntinuous-record streamflow stations and ablishing 8. An updated program of data collec-n and analysis is proposed. (Woodard-USGS)
71-05093

YDROLOGIC REGIMEN OF WALKER LAKE, NERAL COUNTY, NEVADA,
ological Survey, Washington, D.C.
Eugene Rush.
r sale by US Geological Survey, Washington, DC 242-Price $1.00. Geological Survey Hydrologic estigations Atlas HA-415, 1 sheet, 1970. Text, 7 1 tab, 15 ref.

scriptors: *Lake morphology, *Water levels, ater level fluctuations, *Hydrologic data, ydrologic budget, *Nevada, Droughts, cipitation (Atmospheric), Streamflow, Runoff, ter yield, Water quality, Dissolved solids, Water ization, Recreation, Water conservation, aporation, Water balance.
ntifiers: *Walker Lake (Nev), Water budget.

lker Lake is about 60 miles southeast of Carson y, Nev. The town of Hawthorne, Nev., is near south end of the lake. The lake is used prin-ally for boating, water skiing, and fishing. How-r, there is considerable concern for the future of lake because of its rapid stage recession. The al-de of the lake's surface has receded from about 83 feet in 1882 to 3,970 feet in 1968 and the face area has decreased from nearly 69,000 es to 38,000 acres. The maximum depth in 1968 about 118 feet. At the present rate of reces-n, the lake may not reach new equilibrium until lake level recedes another 70 feet, at which e the area might be approximately 25,000 acres and the depth 40 feet. The purpose of this report is (1) to define the area and volume configurations of the lake and (2) to show the effects of recession processes on lake stage, area, volume, and dissolved-solids content. This one-sheet atlas includes a hydrologic regimen map (scale 1:62500) of Walker Lake and eight related tables and illustrations. (Woodard-USGS)
W71-05095

AVERAGE ANNUAL PRECIPITATION AND RUNOFF IN NORTH COASTAL CALIFORNIA,
Geological Survey, Washington, D.C.
S. E. Rantz.
For sale by US Geological Survey, Washington, DC Price 75 cents. Geological Survey Hydrologic Investigations Atlas HA-298, 1968. Text, 1 fig, 4 map, 1 tab, 19 ref.

Descriptors: *Rainfall-runoff relationships, *Hydrologic data, *Maps, *Water resources, *California, Evapotranspiration, Regression analysis, Mathematical studies, Streamflow, Flow rates, Water yield, Runoff, Rainfall, Hydrology, Hydrologic cycle, Vegetation effects, Distribution patterns, Average, Annual, Seasonal, Precipitation (Atmospheric), Drainage systems.
Identifiers: *California (North Coastal), *Hydrologic atlas, Drainage area.

This report consisting of a hydrologic atlas of 4 maps on I sheet and a separate text, presents average annual precipitation, annual precipitation, and runoff in California coastal basins north of San Francisco Bay, and demonstrates a close relation between average annual runoff and average annual precipitation and potential evapotranspiration. Multiple linear regression equations relating these elements are derived for each of the two physiographic sections or subregions in the study area--the Coast Ranges and the Klamath Mountains. The study area includes about 17,000 square miles. The principal streams are the Russian, Eel, Mad, Klamath, and Smith Rivers, all of which drain large interior basins. Most of the other streams in the region drain only the coastal slope of the Coast Ranges. The map showing principal drainage systems and hydrologic units delineates the systems and those units under consideration for project planning. Average annual runoff in the study area totals about 31 million acre-feet, which is the equivalent of about 34 inches of water over the entire area. The long-term basinwide averages range from 7 to 90 inches. (Woodard-USGS)
W71-05096

WATER RESOURCES OF THE WILD RICE RIVER WATERSHED, NORTHWESTERN MINNESOTA,
Geological Survey, Washington, D.C.
T. C. Winter, L. E. Bidwell, and R. W. Maclay.
For sale by US Geological Survey, Washington, DC 20402 - Price $2.00 per set. Geological Survey Hydrologic Investigations Atlas HA-339, 4 sheets, 1970. Text, 25 fig, 18 map, 5 tab, 6 ref.

Descriptors: *Water resources development, *Surface waters, *Groundwater, *Hydrologic data, *Minnesota, Water resources, Surface-groundwater relationships, Precipitation (Atmospheric), Streamflow, Runoff, Hydrogeology, Aquifers, Aquifer characteristics, Water yield, Water quality, Floods, Water utilization, Consumptive use, Water pollution control, Hydrology.
Identifiers: *Wild Rice River basin (Northwestern Minn).

This hydrologic atlas contains 4 sheets (approximately 42x46 inches each) of hydrologic data shown in maps, tables, graphs, and illustrations concerning water resources of the Wild Rice River watershed in Northwestern Minnesota. The annual mean runoff of the entire Wild Rice River watershed is about 1.8 inches or 250,000 acre-feet. Flooding along the lower Wild Rice, Marsh, and Sandhill Rivers is caused by flat land surface, small capacity channels, and low gradient of the channels in the lake plain. The natural streamflow of the Red River of the North is inadequate for a dependable water supply and pollution abatement in the river. Streamflow is supplemented by release of stored water from Orwell Reservoir on the Ottertail River and from Lake Ashtabula on the Sheyenne River in North Dakota. The area with best potential for large yield wells is the outwash and ice-contact sand and gravel in the eastern part of the watershed. Calcium magnesium bicarbonate, the most common water type in the area, occurs mainly in the central and eastern part of the watershed. (Woodard-USGS)
W71-05113

WATER RESOURCES OF THE RED LAKE RIVER WATERSHED, NORTHWESTERN MINNESOTA,
Geological Survey, Washington, D.C.
L. E. Bidwell, T. C. Winter, and R. W. Maclay.
For sale by US Geological Survey, Washington, DC 20402 - Price $2.00 per set. Geological Survey Hydrologic Investigations Atlas HA-346, 4 sheets, 1970. Text, 26 fig, 16 map, 6 tab.

Descriptors: *Water resources development, *Surface waters, *Groundwater, *Hydrologic data, *Minnesota, Streamflow, Runoff, Precipitation (Atmospheric), Hydrogeology, Aquifers, Aquifer characteristics, Water yield, Water quality, Water utilization, Consumptive use, Water resources, Planning, Hydrology, Hydrologic cycle, Floods.
Identifiers: *Red Lake River Basin (Northwestern, Minn).

This hydrologic atlas contains 4 sheets (approximately 42x46 inches each) of hydrologic data shown in maps, tables, graphs, and illustrations concerning water resources of the Red Lake River watershed in Northwestern Minnesota. The hydrologic system within the Red Lake River basin is described and analyzed from a regional viewpoint. It is concluded that any large scale development of water supply within the basin would require additional structural measures to store water either on the land surface or within the groundwater reservoir by using the natural storage capacity of aquifers. The latter alternative would require much more information on the storage capacity of the groundwater reservoir in the particular place of development. Flooding is a major problem within the flat areas of the watershed but measures for considerable control have been completed. In its natural condition the watershed is ideally suited for wildlife propagation throughout much of its eastern part. Potential for water-based recreation is large in the morainal and Upper and Lower Red Lake area. Water supply is a particular problem in the western, highly developed agricultural area of the watershed. (Woodard-USGS)
W71-05114

08. ENGINEERING WORKS

8A. Structures

CONTROL OF WATER POLLUTION DURING DAM CONSTRUCTION,
California State Dept. of Water Resources, Sacramento; and Santa Ana Regional Water Quality Control Board, Riverside, Calif.
For primary bibliographic entry see Field 05G.
W71-04888

LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Amster K. Howard.
Available from NTIS as PB-195 773, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Report No REC-OCE-70-24, June 1970. 72 p, 4 tab, 43 fig, 5 ref.

Descriptors: *Pipelines, Backfill, Soil mechanics, Cohesive soils, Test procedures, Underground structures, Research and development, Laboratory tests, Pressure measuring instruments, *Soil pressure, Pressure sensors, Strain gages, Embankments, Lateral forces, *Steel pipes, Pipes, Strain, Deflection, Deformation, Settlement (Structural).
Identifiers: *Flexible pipes, *Buried pipes, Pressure cells, Loading tests, Iowa Formula, Soil-structure interaction.

In an effort to lower construction costs of closed conduit systems, the Bureau of Reclamation has been investigating the soil-structure interaction of buried flexible pipe. The test pipes are buried in a large container by placing a lean clay soil at optimum moisture around and over the pipe at 90% maximum dry density. Surcharge loads are applied with a universal testing machine. Measurements of soil pressures on the pipe and soil container walls, changing dimensions of the pipe, soil movement around the pipe, and strain on the inner surface of the pipe are made during a 1-day loading sequence. Deflection data from 5 tests reported earlier and 4 additional tests showed good correlation with the Iowa Formula for flexible pipe design. The deformed shape of the pipe ranged from elliptical to rectangular, depending on the ring stiffness of the pipe. One pipe failed by elastic buckling at 8% vertical deflection. Plastic hinges formed in the other pipe between 16 and 22% vertical deflection.
W71-04954

A SYSTEMS STUDY OF SOFT GROUND TUNNELING,
Fenix and Scisson, Inc., Tulsa, Okla; and Little (Arthur D.) Inc., Cambridge, Mass.
C. T. Brandt, R. B. Stone, A. R. Smith, B. H. Willis, and Alex Pastuhof.
Available from NTIS as PB-194 769, $3.00 in paper copy, $0.95 in microfiche. Final Report DOT-FRA-OHS-GT-231, May 1970. 486 p, 3 fig, 15 tab, 266 ref. DOT-FR-9-0034.
Identifiers: *Tunnels, *Subsurface investigations, Subways, Tunneling, Excavation, Underground surveys, Shields, Tunneling, Underground supporting, Tunnel linings, Shotcrete, Reinforced concrete, Soil analysis, Construction equipment, Construction materials, Construction costs, Cost comparison, Systems analysis, *Soft ground tunneling, Advanced planning.

A fundamental investigation of soft-ground tunneling operations was made to identify and assess the potential technical and economic feasibility of new tunneling system concepts. Quantitative estimates were made of costs and rate of advance of different candidate system concepts relative to an assumed set of tunneling conditions. The magnitude of R and D effort required to achieve cost reductions and performance improvements over the 1970 to 1985 time period was estimated. The study concludes that the major restraints to reducing costs and increasing performance in soft ground tunneling over the 1970 to 1985 time period will result from the lack of any effective method for handling bouldery ground and from the lack of a method for rapid installation of the permanent tunnel liner continuously and concurrently with the advance of the face. With a 15-year R and D effort of $35 to $70 million, these problems could be substantially overcome and current tunneling costs could be expected to decrease by 40-65% and advance rates could be expected to increase by a factor of from 4 to 8. Cost differences among the more promising alternative system concepts were found to be small relative to the range of uncertainty associated with the cost forecasts. The most promising areas of new technology were judged to be the dredgehead for excavation; soil-water balance, air-on-face, synthetic resins, and cryogenic freezing for ground control; modular vehicle and hydraulic pipeline for materials handling; and shotcrete and fast setting poured-in-place concrete for tunnel wall support.
W71-05255

OPERATION AND MAINTENANCE MANUAL FOR MISSION HAMMERDRILL.
Mission Mfg. Co., Houston, Tex.

3rd Edition, 1968. 38 p.

Descriptors: *Drilling, *Water wells, *Drilling equipment, Wells.
Identifiers: *Hammerdrill, Percussion drilling, Drilling rate, Drilling operations, Bit weight, Rotation speed, Bit failure, Safety rules, Maintenance.

The Mission Hammerdrill is a pneumatically operated, bottom-hole drill that efficiently combines the percussive action of cable tool drilling with the rotary action of rotary drilling. The Hammerdrill can be used on any standard rotary rig with the necessary air-compressor capacity. It is used for fast and economical drilling of medium-hard formations in quarry, construction, water-well, oil-well, and geophysical work. Fast penetration results from several factors. Because the Hammerdrill is a bottom-hole tool, the piston blows are transmitted directly to the bit without losing percussive energy through the drill string. Thus the air is fully utilized for the rapid impacting action and for blasting and lifting cuttings from the hole. Continuous hole cleaning bares new formation to the bit so that practically no energy is wasted in chewing up cuttings. Straight hole is assured by short, rapid blows that minimize the effect of dipping and broken formation. A straight hole is easier to case and work over, easier to load with explosives or fit with a pump. (Campbell-NWWA)
W71-05289

NOVEL DRILLING TECHNIQUES,
Esso Production Research Co., Houston, Tex.
William C. Maurer.
New York, Pergamon Press, 1968. 114 p.

Descriptors: *Drilling, *Oil industry, Drilling equipment, Rock mechanics, Exploration, Research equipment.
Identifiers: *Rock destruction mechanisms, *Novel drilling techniques, Mechanical drilling, Thermal drilling, Vaporization drilling, Chemical drilling, Drilling performance data, Erosion jet drilling, Turbodrilling, Electric drilling.

Considerable research is going on throughout the world to develop new methods for drilling and excavating rock. In this study novel drills are defined as those which do not use conventional bits to attack rock. Considerable research is being done to develop bottomhole drilling motors such as electric drills and turbodrells. Although the devices described in this study are called novel, many of the concepts involved are quite old, as evidenced by the fact that the first flame drill was patented in 1853 and the first electric arc drill was patented in 1874. What we choose to call novel devices remove rock by four basic mechanisms: mechanically induced stresses, thermally induced stresses, fusion and vaporization, and chemical reactions. These devices have potential applications wherever rock is drilled, crushed, or excavated. Novel rock destruction methods will find initial application where rate of rock removal is more important than unit cost, such as in some military applications. They will also find application where restrictions are imposed on the rock destruction device (such as weight limitation in space exploration or size limitation in deep oil wells). Once novel methods find initial application, they will be refined and improved until their costs are reduced to the point where they find more widespread application in industry. Improvements are continually being made on equipment and techniques, so these new devices must be continually re-evaluated. Because of these continued improvements, some of the new drilling and excavating methods not economical today may find application in a few years. New devices that are exotic today may be conventional tomorrow. (Campbell-NWWA)
W71-05291

WATER WELL DRILLING WITH CABL TOOLS,
Raymond W. Gordon.
Milwaukee, Wisconsin, Bucyrus-Erie Company 1958. 230 p.

Descriptors: *Drilling, *Drill holes, Drilling equipment, Wells, Water supply, Groundwater Sampling, Well screens.
Identifiers: *Cable tool drilling, *Drilling too string, Fishing tool string, Pipe and casing, Drillin problems, Installation of screens, Well develop ment, Mud scow drilling, Bit dressing, We failures, Percussion drilling.

The book admits that there are about as man detailed procedures for drilling a water well wit cable tool equipment as there are drillers, for eac successful driller has developed his own drillin techniques over the years. Since each well differ from every other, an operator must watch develop ments constantly, planning in advance for anythin which might delay operations. For these reasons the material in this book is not set down as a rul but rather as one generally accepted method o handling percussion drills and cable tools. Count less operators have developed drilling and fishin tools to meet their needs. As a result of much in genuity and experimentation, many effective tool are on the market today. Only tools which are i widespread use are discussed. (Campbell-NWWA)
W71-05292

WELL DRILLING OPERATIONS.

Dept Army Technical Manual TM 5-297 and Dep Air Force Manual AFM 85-23, Washington, DC US Government Printing Office, September 1965 249 p.

Descriptors: *Drilling, *Water wells, *Wells, Rotary drilling, Well screens, Pumps, Drawdown, Yield, Logging (Recording), Core drilling, Drilling equipment, Drilling fluids, Potable water, Groundwater.
Identifiers: Driven wells, Dug wells, Jetted wells, Drilled wells, Well construction methods, Percussion drilling, Methods, Well completion, Well development, Suction lift pumps, Deep well pumps, Arctic well development.

The purpose of this manual is to provide instruction and guidance for military personnel engaged in, or responsible for, establishing water sources by the use of wells; providing geological data through the medium of exploratory drilling, core drilling, and sampling; and providing demolition drilling support. It also serves as a basic text for the training of personnel in these areas. This manual covers the military applications of construction techniques for wells of all descriptions to include dug, bored, driven, jetted, and drilled wells. These are the types most likely to be constructed by military personnel in a theater of operations. It describes the use of equipment for developing groundwater sources and for associated uses including exploratory drilling, core drilling and sampling, and demolition drilling support. It discusses the various methods of well construction, related procedures for subsurface soil exploration, and drilling and tunneling for demolition emplacement. Operation of drilling equipment and the latest techniques in drilling for water are described in detail. Use of expedient methods for constructing wells is also described, since they may be required when standard well drilling equipment is not available. Discussed herein also are equipment and aids normally used in civil practice that may be adapted to military use. Multiple wells are discussed and the different types of pipe connections are explained. A chapter describes arctic well construction. (Campbell-NWWA)
W71-05293

AN EXPERIMENTAL STUDY OF INDEXED DULL BIT-TOOTH PENETRATION INTO DRY ROCK UNDER CONFINING PRESSURE,
Rice Univ., Houston, Tex.
P. F. Gmirk, and J. A. Musselman.

Society of Petroleum Engineers of AIME, Preprint No SPE-1712, 1967.17 p.

Descriptors: *Drilling, *Oil industry, Drilling equipment, Rotary drilling, Rock mechanics.
Identifiers: *Dull bit-tooth penetration study, Dry rock, Rock confining pressure, Indexing distance, Bit-tooth force, Optimum indexing distance.

Consideration is given to indexed penetrations by a single dull bit-tooth under statically-applied loads nto rock subjected to confining pressures of atnospheric to 5,000 psi and atmospheric pore pressure. Experimental results obtained with a 45 deg vedge tooth over the above range of pressures are presented for two limestones and a sandstone, a variety of indexing distances, and two degrees of ooth dullness. The optimum distance between successive bit-tooth penetrations required for maxmum rock damage and chip formation decreases ubstantially with increasing confining pressure bove the brittle-to-ductile transition pressure of a articular rock, but remains approximately contant for a variation in confining pressure below the ransition pressure. At a given condining pressure he bit-tooth force required for chip formation is onstant for indexing distances greater than opmum but decreases linearly, in general, with ecreasing indexing distance for distances less than ptimum. The chip-formation force data obtained t confining pressures for which the chip-generaon mechanism is macroscopically of a pseudoslastic nature compares favorably with previous heoretical results for indexed dull bit-tooth enetration into an idealized rigid/perfectly-plastic ock. (Campbell-NWWA)
/71-05303

HE PERFECT-CLEANING THEORY OF ROARY DRILLING,
ersey Production Research Co., Tulsa, Okla.
/. C. Maurer.
ournal of Petroleum Technology, p 1270-1274, ovember 1962. 12 fig, 21 ref.

escriptors: *Rotary drilling, *Oil industry, Drilling, Drilling equipment.
dentifiers: *Perfect-cleaning theory, Crater formaon, Drilling-rate formula, Experimental data, ate-power relationships, Imperfect-cleaning relaonships.

drilling-rate formula for roller-cone bits is erived from rock cratering mechanisms. This forula holds for 'perfect cleaning', which is defined the condition where all of the rock debris is moved between tooth impacts. Under these contions, the drilling rate is directly proportional to e rotary speed and to the bit weight squared, and versely proportional to the bit diameter squared d to the rock strength squared. Under imperfect eaning conditions, such as those usually present field drilling, regrinding of the cuttings occurs der the bit, and the drilling rates fall below those r perfect cleaning. (Campbell-NWWA)
71-05304

FFORTS TO DEVELOP IMPROVED OILELL DRILLING METHODS,
rsey Production Research Co., Tulsa, Okla.
W. Ledgerwood, Jr.
IME Petroleum Transactions, Vol 219, p 61-74, 60. 25 fig, 23 tab, 73 refs.

escriptors: *Drilling, *Oil industry, Drilling uipment, Rotary drilling.
entifiers: *Novel drilling, Flame drill, Bottom le hydraulic rotary, Electric arc, Chemical illing, Pellet impact drill, Shock-wave drill, Calyx ill, Turbodrill, Rocket exhaust drill, Abrasive-jet ill, Continuous core drilling.

uring the past three decades, the oil industry has pended increasing efforts seeking improved illing tools or systems to reduce drilling costs. e total cost of these efforts is unknown, but it rtainly amounts to tens of millions of dollars. ost of the 'new' systems that past and present investigators have sought to develop actually are old public information. In seeking to implement new-system concepts, investigators have tested the following: impact at frequencies ranging from 6 to 300 cycles per second; electrical, mechanical and hydraulic means of actuating percussors; bit rotary speeds up to 2,000 rpm; electric and hydraulic bottom-hole means of rotating bits; bottom-hole machines with power outputs up to 400 hp; shock waves; explosives; high-belocity pellets; flame; arc; grinding wheels; abrasive jets; erosion by high-velocity gases; chemical attack; electric current; magnetic waves; retractable rock bits; reelable drill pipe; continuous coring with reverse circulation; and automation of drilling rigs. In spite of these efforts to discover new and improved systems, rotary drilling maintains its economic leadership. Undoubtedly, rotary drilling costs will continue to be reduced by rigid application of the best available technology and by development of new rotary technology. In view of the extensive past development programs, however, significant long-range improvement appears to be a research, not a development problem. Research must postulate and prove theories and principles governing various subsurface rock-failure processes pertinent to both rotary and new systems. (Campbell-NWWA)
W71-05305

APPLICATION OF ROTARY DRILLING TO WATER WELLS,
J. P. Miller Artesian Well Co., Brookfield, Ill.
W. A. McEllhiney.
Journal American Water Works Association, p 351-355, March 1960.

Descriptors: *Drilling, *Water wells, *Rotary drilling, Drilling eqiupment, Oil industry, Wisconsin.
Identifiers: *Reverse rotary drilling, Well completions, Gravel wells.

In the water supply and industrial fields, rotary drilling equipment has successfully filled a need. It has reduced costs of test hole work and large-bore, gravel-packed wells. Well work involving conventional rotary drilling of large-bore wells (10-20inches) in deep sandstone has rarely been attempted in Wisconsin (1959). The author feels that rotary equipment deserves a fair trial in deep-sandstone type drilling in place of cable-tool drilling. (Campbell-NWWA)
W71-05307

IN HARD ROCK COUNTRY, PERCUSSION TOOL INCREASES DRILLING RATE, CUT COSTS,
Southern Natural Gas Co., Houston, Tex.
Joe B. Cobb.
World Oil, p 116-120, October 1962. 9 fig, 3 tab.

Descriptors: *Drilling, *Oil industry, Rotary drilling, Drilling equipment.
Identifiers: *Percussion rotary drilling, Operation, Economics, Air rotary drilling, Bits, Maintenance.

Southern Natural Gas Company has successfully used the percussion air drilling method to increase penetration rates four to ten times, and reduce over-all drilling costs as much as $16,000 on wells drilled in the hard rock country of San Juan and Grand Counties, Utah. Other advantages of the percussion air drilling technique follow: (1) Wells may be spudded easily in extremely hard formations, (2) straight hole conditions are maintained more easily because of reduced bit load requirements, (3) fewer drill collars are required, (4) less bit wear in some formations extends bit life, reduces required trips to change bits, and (5) larger cuttings are obtained for geologic analysis. Pneumatic percussion drilling now is becoming fully established as an aid to rotary drilling where air or gas can be used as the circulating medium. Although pressures required for operation of the percussion tool are higher (250-400 psi) than those applied in conventional rotary air drilling, booster compressors usually are available at a well for unloading operations and can be used to supply the higher pressure air needed for percussion tool operation. The extra energy is used to achieve increased chipping action at the bit and a higher penetration rate, and is especially effective in hard or brittle formations. (Campbell-NWWA)
W71-05308

BOTTOM-HOLE PERCUSSION TOOLS-WHERE AND HOW TO USE THEM,
Mission Manufacturing Co., Houston, Tex.
S.C. Berube, and R. N. Young.
Rock Products, p 79-81, October 1966.

Descriptors: *Drilling, *Oil industry, Wells, Drilling equipment.
Identifiers: *Bottom-hole percussion tool, Air volume requirement, Drill pipe size, Torque, Rotation speed, Water injection, Maintenance, Penetration rate.

Bottom hole percussion tools and bits are generally used under conditions where other drilling methods are uneconomical due to slow penetration rates, high bit costs or high rig maintenance costs. Requirements to insure the successful application of the bottom hole percussion drilling method are: (1) Adequate volume of compressed air to efficiently clean the hole, (2) Proper size drill pipe, (3) Sufficient pull down on the drill stem to keep the bit engaged against the rock face to be drilled, (4) Sufficient torque to turn the drill stem when the tool is drilling, (5) An adjustable speed rotary mechanism, (6) A means of tool lubrication, (7) Adequate hoisting capacity to lift the tool and drill pipe from the deepest hole the driller expects to drill, (8) Proper breakout equipment to service the tool, (9) A means of sharpening bits. (Campbell-NWWA)
W71-05309

DRILLING FOR THE MAN ON THE RIG,
Oil and Gas Journal, Tulsa, Okla.
Preston Moore.
Technical Manual Reprint, Oil and Gas Journal, 1966. 72 p.

Descriptors: *Drilling, *Oil industry, *Rotary drilling, Equipment, Drilling fluids, Muds, Cement grouting.
Identifiers: *Drilling control factors, *Drilling fluid selection, Drilling fluid composition, Drilling fluid control, Drilling fluid circulation, Hole conditions, Rotary drilling hydraulics, Hole problems, Primary cementing mechanics, Air and gas drilling, Minimum-cost drilling.

The men on the rig spell the difference between economic success and failure in drilling operations. The best technology is useless if it is not applied on the rig daily. This manual is an effort to improve drilling operations. This series of articles incorporates the latest in technology for use by the man in the field. The first step in planning a new well should be a review of all the available information on past wells in the area. This information should be evaluated to determine practices that should and should not be used in the proposed well. This means that second guessing is an accepted as well as a necessary practice. Information, from the bit to use to the best cementing procedures, can save considerable drilling time and trouble. (Campbell-NWWA)
W71-05314

NEWS TOOLS AND PROCEDURES FOR BETTER DRILLING OPERATIONS,
Oil and Gas Journal, Tulsa, Okla.
H. G. Bentson.
Technical Manual Reprint, Oil and Gas Journal, 1964. 56 p.

Descriptors: *Drilling, *Oil industry, *Rotary drilling, Equipment, Drilling fluids, Mud.
Identifiers: *Rock-bit design, *Rock-bit selection, Rock-bit evaluation, Cyclone samplers, Drilling

rates, Turbodrill, Turbodrill bit, Formation compressive strength, Surfactants, Rotary speed, Bit weight, Air drilling, Mud drilling.

This booklet describes in considerable detail the various aspects of rock-bit design, selection and evaluation. In addition, rotary drilling rate is examined. Variables affecting rotary-drilling penetration rate are exceedingly numerous. Some of the more recognizable are the effects of drilling-fluid properties, hydrostatic pressure, hydraulic factors, rotary speed, and weight on bit. Also involved are personnel-rig efficiency, straight-hole requirements, and the extreme variance of rock properties and other subsurface conditions in different areas. The various features of the turbodrill is discusses with emphasis on the present lack of adequate bit design features and supporting mud pump capacities. (Campbell-NWWA)
W71-05316

HOW TO COMBAT LOST CIRCULATION,
Oil and Gas Journal, Tulsa, Okla.
J. U. Messenger, J. W. Murray, J. Kelly, Jr., J. R. Eckel, and R. A. Bobo.
Technical Manual Reprint, Oil and Gas Journal, 1969. 50 p.

Descriptors: *Drilling, *Oil industry, Equipment, Drilling fluids, Mud, Rotary drilling.
Identifiers: *Lost circulation, Mud hydraulics, Drilling rate, Problem shales, Parasite tubing string.

Lost circulation is the most troublesome and costly problem in drilling. While no functionally new lost-circulation materials or techniques have been developed in the past 10 years, progress has been made by using existing techniques and materials more effectively. The purpose of this series of articles is to outline these more effective procedures of lost-circulation prevention and control. The different types of loss zones are classified on the basis of severity. Then the different materials and techniques are matched to type and severity of the zone they most likely can cure. Attention is given to methods of preventing lost circulation, and a list is given of the most usual causes of failure to control lost circulation. (Campbell-NWWA)
W71-05317

NEW EQUIPMENT AND OPTIMUM DRILLING TECHNIQUES MAKE FOR BETTER DRILLING PRACTICES,
Oil and Gas Journal, Tulsa, Okla.
E. M. Galle, H. B. Woods, W. R. Greene, L. C. Rogers, and H. M. Rollins.
Technical Manual Reprint, Oil and Gas Journal, 1967. 69 p.

Descriptors: *Drilling, *Oil industry, *Rotary drilling, Equipment, Drilling fluid, Mud.
Identifiers: Constant bit weight, Constant rotary speed, Packer terminology, Tool joints, Drill pipe, Drill collars, Electric drive rig, Rig design.

For each particular drilling situation and rig, there is some 'best' combination of bit weight and rotary speed. If this weight and speed are held constant throughout the bit run, they produce the lowest possible cost. No other combination of speed and weight held constant will be so efficient. This booklet lays out in cook-book fashion a method of the figuring the best constant bit weight and rotary speed. Other topics covered include: Packer terminology and recommended standardization, ways of assuring money's worth from tool joints and drill pipe, ways of avoiding drill collar damage, and new ideas on electric drive rigs. (Campbell-NWWA)
W71-05318

HOW TO SELECT THE CORRECT SAND CONTROL SYSTEM FOR YOUR WELL,
Dow Chemical Co., Los Angeles, Calif. Dowell Div.
A. W. Coulter, and D. G. Gurley.
Society of Petroleum Engineers of AIME, Preprint No SPE-3177, 1971. 6 p, 10 ref.

Descriptors: *Screens, *Permeability, Oil industry, *Water wells, Drilling.
Identifiers: *Sand control system, *Water well completion, Gravel packs, Resin sand consolidation, Resin-coated gravel packs.

There has long been a need for a guide to the selection of the sand control system needed for a particular well. There are four types of systems in use today: (1) screens, (2) gravel packing, (3) sand consolidation and (4) a resin-coated particulate such as sand. Although universal agreement may not be possible at this time, there are certain guidelines that are followed. The factors involved include formation permeability, clay and silt content of formation, interval length, number of zones, homogeneity, well history, type completion, depth, expense of right time and others. This paper will consider these factors and their influence on the selection of sand control systems. (Campbell-NWWA)
W71-05320

HOLE CLEANING,
Shell Development Co., Houston, Tex.
E. A. Hopkin.
Society of Petroleum Engineers of A.I.M.E., Preprint No SPE-1697, 1967. 12 p.

Descriptors: *Drilling fluids, *Drilling, Rotary drilling, Drilling equipment, Muds, Oil industry.
Identifiers: *Drilling rate, *Theory of particle settling, Viscosity effect, Mud density effect, Drill-pipe rotation effect, Cuttings removal rate, Hole enlargement, Stuck drill pipe.

Laboratory tests conducted by Shell Canada, Ltd. together with actual field experience have indicated the magnitude of some of the factors affecting the ability of the drilling mud to clean the hole. A correlation was observed between funnel viscosity and particle slip velocity. A relationship was also observed between the Bingham yield value of the mud and the particle slip velocity. No change is slip velocity was observed with funnel viscosities up to about 80 sec/qt. or to yield values of about 15 lb/100 sq ft. The slip velocity of the particles studied varied from 120 ft/min. with water to close to 0 ft/min. for high mud viscosities. Increasing the mud density, creating laminar annular mud flow or rotating the drill pipe appeared to improve the carrying capacity. Field tests indicated that during fast upper-hole drilling, the rate of cutting removal must be sufficient to maintain the concentration of cuttings in the annulus at less than 5 per cent by volume to prevent balled-up drill collars and stuck drill pipe. (Campbell-NWWA)
W71-05321

THE STRAIGHT HOLE TURBODRILL,
Eastman Oil Well Survey Co., Tulsa, Okla.
David B. Shulz.
Society of Petroleum Engineers of A.I.M.E., Preprint No SPE-3230, 1971. 8 p, 8 fig, 4 tab.

Descriptors: *Drilling, *Drilling equipment, Rotary drilling, Oil industry, Core drilling.
Identifiers: *Turbodrilling, Directional turbodrilling, Straight-hole turbodrilling, Turbodrill application, Turbodrill diamond bits, Horsepower requirements.

From the first patent of a turbodrill in 1884, a span of 70 years of development and improvement was necessary before the beginning of its use as a directional drilling tool. Improvements in directional turbodrills led to the marketing of the straight-hole turbodrill and its use in problem areas of vertical wells and directional wells. Diamond bits used with turbodrills must be built with large water courses and low pressure drop across the face. Cleaning and cooling is accomplished by changes in the flow characteristics of the fluid as the rotating speed of the bit is increased. Horsepower output of a turbodrill is affected by changes in the number of turbine stages in flow rate and in volume of fluid. A summary of drilling records show some applications of the turbodrill. Greater drilling depths of the future will present more problem and more applications of all down-hole motor (Campbell-NWWA)
W71-05323

8B. Hydraulics

ANALYSIS OF THE USE OF DISTORTE HYDRAULIC MODELS FOR DISPERSION STU DIES,
California Univ., Berkeley. Dept. of Civil Enginee ing; and Illinois Univ., Urbana. Dept. of Civil E gineering.
For primary bibliographic entry see Field 02E.
W71-04853

FLOOD ROUTING THROUGH STORM DRAINS: PART I. SOLUTION OF PROBLEM OF UNSTEADY FREE SURFACE FLOW I STORM DRAINS,
Colorado State Univ., Fort Collins. Dept. of Civ Engineering.
For primary bibliographic entry see Field 04A.
W71-04890

FLOOD ROUTING THROUGH STORM DRAINS: PART II. PHYSICAL FACILITIE AND EXPERIMENTS,
Colorado State Univ., Fort Collins. Dept. of Civ Engineering.
For primary bibliographic entry see Field 04A.
W71-04891

FLOOD ROUTING THROUGH STORM DRAINS: PART III. EVALUATION OF GEOMETRIC AND HYDRAULIC PARAME TERS,
Colorado State Univ., Fort Collins. Dept. of Civi Engineering.
For primary bibliographic entry see Field 04A.
W71-04892

WATER HAMMER AND SURGE TANKS,
G. V. Aronovich, N. A. Kartvelishvili, and Ya. K. Lyubimtsev.
Available from NTIS as TT70-50025, $3.00 in paper copy, $0.95 in microfiche. Trans. of Gidravlicheskii Udar i Uravnitelnye Rezeruary Moscow, 1968. Israel Program for Scientific Translations, 1970. 209 p. Jerusalem, 1970. 203 p.
Identifiers: *Water hammer, *Hydraulic equipment, *Surge tanks, Performance, Unsteady flow, Pipes (Tubes), Theory, Oscillations, Stability, Translations, USSR.

The book considers unsteady motion of liquids in hydraulic pressure systems (hydroelectric power stations, water and petroleum conduits, pressure irrigation systems, hydraulic fuel supply systems, etc.). The general theory of water hammer is presented for simple conduits and complex piping systems. Probability problems of water hammer related to the probability nature of laws governing valve closure are considered, as well as the relationship between these problems and conduit reliability. Surge-tank operation is considered from the following points of view: (1) as a means of damping out water hammer; (2) as a device having a substantial effect on the stability of steady hydraulic regimes; (3) as device whose overall dimensions must be established by hydraulic calculations. The relationship between water hammer and fluctuations of the liquid masses in the surge tanks is analyzed.
W71-04940

EXPERIMENTAL FLUME INVESTIGATION OF HYDRAULIC TRANSIENTS IN RIVER-RESERVOIR SYSTEMS,
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 02E.
W71-05087

APPROXIMATE SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR FLOW THROUGH A RECTANGULARLY PACKED BED OF SPHERES,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02F.
W71-05111

PRACTICAL RESERVOIR ENGINEERING,
Tulsa Univ., Okla.
E. T. Guerrero.
Tulsa, Oklahoma, Petroleum Publishing Company, 1968. 266 p.

Descriptors: *Oil industry, *Hydraulics, *Aquifers, *Groundwater, Design, Porosity, Permeability, Rock properties, Logging (Recording), Electric log, Unsteady flow.
Identifiers: Effective porosity determination, Washburn-Bunting porosimeter, Microlog, Microlaterlog, Neutron-Derived porosity curve, Absolute permeability, Effective permeability, Productivity index, Steady-state relative-permeability measurements, Interstitial-water saturation determinations, Smith equation, Curtis and Brinkley method.

The practical methods of the petroleum industry for reservoir engineering are presented in 102 parts. Practical applications are emphasized and enough theoretical concepts and references are included to give interested readers the fundamentals of the methods used by the petroleum industry. This book demonstrates most of the practices and concepts used by the industry which overlap similar practices used in the groundwater industry. Significant semantic differences exist but considerable advances have been made which should have spin-off value for use in groundwater engineering, especially as deeper groundwater is sought in the future and increased pressures, temperatures, etc., are encountered. The text is well-illustrated and well-referenced and should be of interest to workers involved in groundwater reservoir studies. (Campbell-NWWA)
W71-05290

BAROID DRILLING MUD DATA BOOK.
National Lead Co., Houston, Tex. Baroid Div.

Houston, Texas, National Lead Company, Baroid Division, 1954. 471 p.

Descriptors: *Drilling fluids, *Drilling, *Oil industry, Emulsions, Foaming, Mud, Wells, Expansive clays, Bentonite.
Identifiers: Drilling mud properties, Chemical treatment, Oil muds, Basic mud mixing, Drilling mud costs, Mud field tests, Drilling mud problems, Lost circulation, Drilling mud engineering, Aquagel, Impermex, Baroco, Zeogel, Anhydrox, Emulsion mud.

This reference is a complete text on drilling fluid theory and application despite its commercial intent. The following topics are discussed in detail; History, function and types of drilling mud, clays, weighing material, chemical treatments, oil mud use, basic mud mixing techniques, cost appraisals, field testing, trouble shooting, lost circulation problems and their solution. The text is well illustrated and referenced and has been updated since its publication in 1954. An extensive glossary is also included. The text constitutes 14 sections, each being self-contained. (Campbell-NWWA)
W71-05294

PETROLEUM ENGINEERING, DRILLING AND WELL COMPLETIONS,
Texas Univ., Austin.
Carl Gatlin.
Englewood Cliffs, New Jersey, Prentice-Hall Inc., 1960. 341 p.

Descriptors: *Drilling, *Oil industry, *Rotary drilling, Drilling equipment, Sampling, Drilling fluids, Logging (Recording), Cementing, Casing.
Identifiers: *Well completion, Drill stem testing, Formation damage, Core analysis, Penetration rate, Rotary drilling hydraulics, Cable tool drilling, Rock properties.

The book presents an integrated picture of oil well drilling and well completion operations as they are normally encountered by the petroleum engineer. In order to do this without assuming prior knowledge in the field, a number of rather general topics have been included. The chapters on reservoir fluid properties, reservoir rock properties, exploration and leasing practices, core analysis, well logging and formation damage fall into this category. The emphasis is on the specific problem rather than an over-all implications. Petroleum engineering curricula vary widely as to the level at which the drilling course is taught. By including the necessary background material, this text could be considered a first course. It is well illustrated and contains adequate references. (Campbell-NWWA)
W71-05296

WHAT'S NEW WITH MUD.
National Lead Co., Houston, Tex. Baroid Div.

Special Report, 1966. 35 p.

Descriptors: *Drilling fluids, *Drilling, *Oil industry, Emulsions, Foaming, Mud, Wells, Expensive clays, Bentonite, Corrosion.
Identifiers: *Drilling mud properties, Drilling rate, Hole stability, Solids control, Temperature stability, Rheology, Limestone and sandstone penetration rates, Wet shales, Swelling shales, Shale shakers.

Like most other phases of the petroleum industry, the technology, techniques and products used in drilling fluids changed significantly during the middle 1960's. This booklet is an attempt to update previous work on drilling mud developments and techniques. Improvements in drilling rates using new mud techniques have been realized. Hole stability techniques have also been improved as have techniques of solids control, downhole mud temperature stability and corrosion. This booklet is very well illustrated. New experimental studies are discussed. (Campbell-NWWA)
W71-05301

EFFECT OF MUD COLUMN PRESSURE ON DRILLING RATES,
Imperial Oil Ltd., Calgary (Alberta).
A. S. Murray, and R. A. Cunningham.
AIME, Petroleum Transactions, p 46-54, 1956. 11 fig, 10 ref.

Descriptors: *Drilling fluids, *Mud, *Drilling, *Oil industry, Rotary drilling.
Identifiers: *Drilling rate, *Drillability, Confining pressure, Bit load, Drag bit.

If a dense fluid such as mud or water is used for circulation, the formation drilled is influenced by a hydrostatic pressure. This pressure depends on hole depth and drilling fluid density. Laboratory tests indicate that drilling rates in many formations are decreased with increased pressure - in some cases as much as 90 per cent. A comparison between laboratory and field tests indicate that drilling fluid head affects drilling rates in the field approximately the same as in the laboratory. Drilling rates of many formations are increased by reducing drilling fluid head. (Campbell-NWWA)
W71-05311

8C. Hydraulic Machinery

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL. 5, SECTION G - SYSTEMS ANALYSIS OF HYDROPOWER PRODUCTION ON THE WISCONSIN RIVER,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05039

THERMOELECTRIC GENERATORS POWERED BY THERMAL WASTE FROM ELECTRIC POWER PLANTS,
Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest, Water Lab.
M. A. Shirazi.
Federal Water Quality Administration, Water Pollution Control Research series 16130, September, 1970 presented at the IECEC Energy 70 Conference, Las Vegas, Nevada, Sept, 1970, p 27. 5 fig, 5 tab, 6 ref.

Descriptors: *Thermal pollution, *Electric powerplants, Heat exchangers, Condensers, Costs, Heat transfer, Temperature, Cooling water, Water pollution control, *Thermal powerplants.
Identifiers: *Thermoelectric generators, Thermal waste, Turbine back pressure, Power density, Power intensity.

A crossflow type heat exchanger with the plate fin surface geometry is described. The plate separating the hot fluid from the cold fluid contains the thermoelectric unit. Equations for calculating convective heat transfer coefficients, the friction power extended per unit surface area and the maximum conversion efficiency are described. The alloys considered in this study were Bi2Te3 - Bi2Se3 (n type) and Bi2Te3 - Sb2Te3 (p type). While conducting the latent heat from the condensing steam to the cooling water, the couples convert a portion of this heat to electricity. A second source of waste heat in a conventional fossil-fueled electric powerplant is the hot stack gases released into the atmosphere. Another source is hot exhaust gases from a gas turbine electric power system. Condenser performance data are presented in three separate tables. Power generated increases with turbine back pressure. A capital cost estimate for three plate module thickness of 0.01, 0.02 and 0.05 inch are estimated at $1250, $1560 and $3720 per kw, respectively. Ratio of the cost of thermoelectric to stream electric generation increased with plate thickness and is as high as 14 for a plate thickness of 0.05 inch. It is uneconomical, at the present time, to use thermoelectric devices to generate electricity from waste heat. (Upadhyaya-Vanderbilt)
W71-05121

WATER TRANSPORT OF THE ODD-SHAPED HEAVY RUNNERS OF LARGE FRANCIS HYDRAULIC TURBINES,
Bureau of Reclamation, Denver, Colo.
M. I. Galperin, and A. V. Chekulaev.
Available from NTIS as PB-193 593, $3.00 in paper copy, $0.95 in microfiche. Translated from Energomashinostroenie No 2, p 45, 1966. Bureau of Reclamation Translation No 674, Sept 1966. 7 p, 2 fig, 1 ref.

Descriptors: Turbine parts, *Turbine runners, Hydraulic turbines, *Francis turbines, Foreign projects, Handling equipment, *Transportation, Hoisting machinery, *Waterways, Sandbars, Rivers, Boats, Weather, Loads, Ports, Locks, Barges.
Identifiers: Krasnoiarsk Powerplant (USSR), North Sea-Baltic Wtrwy (USSR), Enisei River (USSR), Leningrad Metalworks (USSR).

During the summer of 1965 the first two runners for the Krasnoiarsk 508-mw turbines were successfully transported from the Leningrad Metalworks (LMZ) pier to the construction site of the hydrocomplex on the Enisei River in Siberia. The runners were loaded one at a time at the LMZ pier from railroad transport flatcars to a lighter. At the Leningrad Commercial Seaport they were unloaded by the harbor facilities and then reloaded together with two generator thrust bearing tanks into the hold of a single sea-going barge. The route was through the White Sea-Baltic Seaway, containing numerous, relatively small, one- or two-chambered locks, where the help of tugs and warping hawsers was needed to lock the barge. Through the Northern Seaway along the coast of the Arctic

Ocean, fogs, icepacks, and stormy weather were encountered, but the method of loading and lashing the runners proved to be satisfactory. The Enisei River has many rapids and sandbars from its mouth to the unloading point at Divnogorsk. These required the help of special local tugs and a river pilot. Docking and unloading the runners each required less than 24 hours to accomplish. Success in handling these loads confirms the possibility of handling and transporting the runners for the Aswan High Dam turbines to the UAR in the same way.
W71-05251

SYSTEMS OF HYDRAULIC AUTOMATIC CONTROL IN IRRIGATION CANALS,
Bureau of Reclamation, Denver, Colo.
I. B. Khamadov, F. Ya. Eingorn, and L. A. Om.
Available from NTIS as PB-193 649T, $3.00 in paper copy, $0.95 in microfiche. Translated from: Gidrotekhnika i Melioratsiya No 3, p 36-48, 1967. Bureau of Reclamation Translation No 723, Jan 1968. 35 p, 6 fig, 12 ref.
Identifiers: *Irrigation systems, Automation, *Hydraulic systems, Design, Control systems, Costs, Operation, USSR, Translations, Water use, Irrigation canals.

Several institutions in the Central Asian republics of the USSR have cooperated to develop an automated system of hydraulic controls for irriagation canals. After studying foreign and domestic systems of upstream and downstream controls of all types, they devised a mixed-control system, actuated by direct and reflected hydraulic surges in the canal. This system combines the advantages and features of both upstream and downstream hydraulic controls without a number of their separate disadvantages, but requires canal bottom slopes of less than 0.0003 and costs 9 to 22% more to build than a system with just upstream control. However, the mixed control system is easier, more flexible, and more reliable in operation.
W71-05252

BEST CONSTANT WEIGHT AND POTARY SPEED FOR ROTARY ROCK BITS,
Hughes Tool Co., Houston, Tex.
E. M. Galle, and H. B. Woods.
Reprint: Presented at the Spring Meeting of the Pacific Coast District Division of Production, American Petroleum Institute, Los Angeles, May 1963. 37 p.

Descriptors: *Drilling, *Oil industry, Drilling equipment, *Rotary drilling, Rock excavation, Rock mechanics, Drill holes, Drilling fluid.
Identifiers: *Mathematical analysis, Drilling rates, Optimum rotary speed, Optimum constant weight, Drilling cost, Teeth condition, Bearing life, Formation characteristics.

This is a study of the best constant weight and rotary speed for lowest drilling cost for rolling cutter rock bits. Graphs and charts for a variety of formations are presented for field application. The results of several field test are as follows: (1) mathematical relations have been developed for determining the best constant weight and rotary speed for lowest drilling cost, (2) graphs and procedures have been developed to determine: (a) the best combination of constant weight and rotary speed, (b) the best constant weight for any given rotary speed, (c) the best constant rotary speed for any given weight, (3) in each graphical procedure of the above, drilling cost, footage, drilling time and condition of teeth and bearings of the dull bit may be calculated. (4) Field tests have demonstrated that drilling costs may be reduced by using the weight and rotary speed combinations recommended in this study. (Campbell-NWWA)
W71-05297

ROTARY DRILLING BITS.
Hughes Tool Co., Houston, Tex.
Houston, Texas, Hughes Tool Company, 1966. 37 p.

Descriptors: *Drilling, *Oil industry, *Water wells, Wells, Drilling eqiupment, Drilling fluids, Rotary drilling.
Identifiers: *Rotary drilling bit design, Rock drillability, Bit types and usage, Circulating media, Dull bits, Drilling records.

The introduction of the rolling conical cutter bit greatly increased the economic feasibility of drilling hard formations and led to the general acceptance of the rotary method of drilling oil and water wells. Most types of rock bits will make fair progress in the majority of formations. However, to obtain maximum footage with lower drilling costs, the type of bit should be designed for the specific type of formation being drilled. Various types of bits, several different broad classifications of formations and the types of rock bits best suited to drill them is examined. Examination of dull bits can often furnish information that will assist the selection of bit types and help to determine operating practices. Other topics such as (1) importance of bit records, (2) importance of using proper drilling muds with bits, and (3) selection and operation of rolling cutter bits are discussed. Excellent illustrations are included. (Campbell-NWWA)
W71-05298

KNOW YOUR MUD PUMP,
Mission Mfg. Co., Houston, Tex.
S. L. Collier, W. E. Liljestrand, C. V. Aalaund, N. B. Heaps, and C. P. Reid.
1965. 64 p.

Descriptors: *Drilling fluids, *Pumps, Centrifugal pumps, Hydraulic systems.
Identifiers: *Mud pump research, Normal pump behavior, Friction losses, Suction dampeners, Pressure requirements, Hydraulic knocking, Mechanical knocking, Discharge pressure system, Volumetric efficiency, Reciprocating mud pumps.

Drilling costs can be reduced through a better understanding of the mud pump and accessory equipment. The preliminary results of controlled laboratory tests made with modern instrumentation will aid in acquiring a better knowledge of pump operation. The mud pump is the main element of the surface mud system, but it is only a link in the three element chain consisting of the suction system, the mud pump itself and the discharge system. The actual requirements of the suction system must be understood in order to establish the correct operating conditions for the mud at the pump suction flange. To know what is required of the suction system, both the normal and abnormal situations that occur during, and as a result of, the suction stroke of the piston must be understood. In the discharge stroke, the piston's pattern of motion is molded into a completely different pattern by the complexity of the discharge system. Each element of the system should be operated for the maximum effectiveness by controlling the problems of each through the best use of the piping and the mud reserve, or when necessary, the proper use of the auxiliary equipment. (Campbell-NWWA)
W71-05300

BIT TIPS,
Hughes Tool Co., Houston, Tex.
M. A. Foreman, R. J. Schneider, J. H. Cook, W. J. Highbarger, and T. B. Smith.
Vol 2, 1970. 33 p.

Descriptors: *Drilling, *Oil industry, *Water wells, Wells, Drilling equipment, Drilling fluids, Rotary drilling, Logging (Recording).
Identifiers: *Bit design, *Bit stabilization, Jet nozzles, Bit selection, Bit bearings, Super bit, Well planning, Bit weight, Rotary speed, Formation characteristics, Well logs.

In designing rock bits, space is the controlling factor because the sizes of the parts are determined by the size of the hole to be drilled. Proper selection the right proportions for the various parts, such tooth size, cone shell thickness, and bearing size required. It is known that rock bits perform b when rotating about their own axis. Bearing li because of reduced thrust loading, is also extend when the bit rotates about its own center - es cially under maximum loading. The advent of bits was major breakthrough in obtaining grea penetration rates. Properly directed jet strea combined with correct nozzle sizes clean the cor of the bit and provide efficient removal of cuttin from bottom. Other topics such as bit stabilizati well logs and bit selection, and optimum bit weig and rotary speed are also discussed. (Campbe NWWA)
W71-05302

RUSSIAN TURBODRILLS.....HOW GOOD AR THEY.
World Oil Publishing Co., Tulsa, Okla.

World Oil, p 151-158, December 1956.

Descriptors: *Drilling, *Drilling equipment, Rota drilling, Oil industry.
Identifiers: *Russian turbodrills, Penetration rate Developmental history, Turbodrill-convention rotary comparison.

In recent months (1956), the drilling indust became aware of the possibilities inherent in havi a down-hole source of power for driving the dr bit. Scattered and unsuccessful test have been ca ried on in the U.S. since 1873, but with the r ported success of Russian turbodrilling there w widespread interest in this method. Tool manufa turers and drilling personnel anxiously awaited th results of the tests to be conducted on 40 importe Russian turbodrills. Dresser Industries were activ in the development and testing of earlier America turbodrills. (Campbell-NWWA)
W71-05306

PORTLAND HARBOR EVALUATION,
Maine Port Authority, Portland.
For primary bibliographic entry see Field 05G.
W71-05327

8D. Soil Mechanics

FLOW THROUGH A TAILINGS POND EM BANKMENT,
Bureau of Mines, Spokane, Wash., and Idaho Univ., Moscow.
C. Dan, aKealy, and Roy E. Williams.
Water Resources Research, Vol 7, No 1, p 143 154, February 1971. 12 p, 9 fig, 2 tab, 15 ref.

Descriptors: *Earth dams, *Seepage, *Under seepage, *Mine wastes, *Laplaces equation, Dam failure, Earthworks, Ponding, Dam design, Flow Porous media, Water levels, Drainage, Leakage Hazards, Model studies, Hydraulic models, Mathematical models, Computer models.
Identifiers: *Tailings ponds.

Mathematical models that solve the Laplace or Richards' equation numerically are used to locate the phreatic surface within a mine tailings pond embankment and to define the subsurface flow system that transports water outward from the pond. Input data needed for the finite element model include the saturated hydraulic conductivity distribution within and beneath the embankment, the fluid potential values at both upgradient and downgradient boundaries of the embankment, and the geometry and elevation of an approximately impermeable layer at some depth beneath the surface of the embankment. This technique was applied to a tailing disposal system in northern Washington. Laboratory tests were used to obtain permeability values. Pond boundaries were examined by drillholes and piezometers. Piezometers were also used to validate the configuration of the

hreatic surface predicted by the model. Of par-
cular importance to slope stability analysis is the
ct that both the model and the check piezometers
dicate that a significant portion of the phreatic
rface within the embankment is concave upward.
xperimentation with the finite element model
evealed that the concave upward portion is a con-
equence of the upstream boundary in a tailings
nd being a flow line and embankment permea-
lity being lower near the upstream boundary; the
ostream boundary of the flow region in an earth
m is normally an equipotential line. (Knapp-
SGS)
71-04862

TABILITY OF CLOSED HORIZONTAL
RAINAGE IN THE GOLODNAYA STEPPE,
ureau of Reclamation, Denver, Colo.
M. Ostrovskii, and A. A. Dyadik.
vailable from NTIS as PB-193 616T, $3.00 in
per copy, $0.95 in microfiche. Translated from:
drotekhnika i Melioratsiya Vol 18, No 6, p 22-
, 1966. Bureau of Reclamation Translation 684,
t 1967. 21 p, 12 fig, 6 ref.
entifiers: *Hydrology, USSR, *Soils, Drainage,
sign, Stability, Sand, Clay, Deformation, Floods,
anslations, Golodnaya Steppe.

e results of laboratory investigations of the filter-
g stability of Golodnaya Steppe soils with various
pes of filters, as well as the critical analysis of in-
stigations under natural conditions indicated
ps necessary in planning a drainage system.
71-05254

W-TEMPERATURE PHASES OF INTERFA-
AL WATER IN CLAY-WATERS SYSTEMS,
ld Regions Research and Engineering Lab.,
nover, N.H.
r primary bibliographic entry see Field 02C.
71-05258

E OF GEOPHYSICAL LOGS IN SOIL EN-
NEERING,
andrel Industries, Houston, Tex. Well Instrument
v.
bert Guyod.
nerican Society for Testing and Materials, Spe-
l Technical Publication No 351, p 74-85, 1963.
fig, 2 tab, 8 ref.

scriptors: *Logging (Recording), *Water wells,
oil engineering, Electrical well logging, Radioac-
e logging, Drilling, Coring, Groundwater.
ntifiers: *Accoustical logging, *Test wells,
gging methods, Electrical resistivity, Natural
mma Ray logging, Gamma-Gamma logging,
utron logging, Velocity logging, Matrix velocity.

e measurement of some of the physical proper-
s of the soils and rocks penetrated by bore holes
vides information of value to the soil engineer.
ctrical resistivity, radiation, and acoustical pro-
rties are particularly useful. The measurements
ntinuously recorded in terms of depths give a
ailed log on which geological and physical
anges are indicated. In a typical case, the field
erations are conducted as follows: (1) A small
mber of test wells scattered over the area of in-
est are drilled, cored, and logged with one or
veral appropriate probes; (2) additional holes are
n drilled between the test wells; and (3) these
es are logged but not cored. By correlating the
s and the core data the geology of the area and
ne of the rock properties can be mapped. None
the methods reviewed, however, can be used to
asure dynamic properties. The main advantages
geophysical logs are that detailed information is
dily obtained at the well sites and at a lower cost
n if each hole were cored. The equipment used
the logging of shallow holes is small, light,
ged and simple. No special technician is needed
its operation. (Campbell-NWWA)
71-05310

8E. Rock Mechanics and Geology

AN EXPERIMENTAL STUDY OF INDEXED DULL BIT-TOOTH PENETRATION INTO DRY ROCK UNDER CONFINING PRESSURE,
Rice Univ., Houston, Tex.
For primary bibliographic entry see Field 08A.
W71-05303

IN HARD ROCK COUNTRY, PERCUSSION TOOL INCREASES DRILLING RATE, CUT COSTS,
Southern Natural Gas Co., Houston, Tex.
For primary bibliographic entry see Field 08A.
W71-05308

ANNOTATED TABLES OF STRENGTH AND ELASTIC PROPERTIES OF ROCKS,
Illinois Univ., Urbana.
Rudolph G. Wuerker.
AIME, Petroleum Transactions Report No 6, p 23-45, 1969. 7 fig, 5 tab, 75 ref.

Descriptors: *Rock mechanics, *Drilling, *Mining, Physical properties, Oil industry, Sandstone, Limestone, Granite, Marble, Rocks, Strength, Mohr envelop.
Identifiers: *Drillability, *Grindability, *Blastability, U.S. Bureau of Mines, U.S. Bureau of Reclamation, Mhr's hardness scale, Load influence, Temperature factor, Time factor.

Testing for strength and elastic properties of rocks has made rapid progress since the end of World War II. The perfection of standard methods and the awakening interest of all branches of the mineral industry resulted in the collection of a great amount of new physical data on the most common rocks. Interpretation and correlation with technological properties, such as grindability, drillability, and blastability, however, have not kept pace. One of the reasons for this may be the fact that test results on strength and elastic properties are widely scattered in the technical literature. The purpose of this paper is to tabulate the results from such standardized tests and to discuss the importance of each property and its usefulness to the mineral engineer as reflected in the existing literature. Twenty-one rock properties are listed in tables, which have been encountered in mining and petroleum exploration. Not all twenty-one properties have been measured as yet from any one rock but an attempt is made to make the various results match as well as possible. The report is exceptionally well referenced. (Campbell-NWWA)
W71-05312

A NEW APPROACH TO INTERPRETING ROCK DRILLABILITY,
Petroleum Publishing Co., Tulsa, Okla.
M. Grant Bingham.
Technical Manual Reprint, Oil and Gas Journal, 1965. 93 p.

Descriptors: *Drilling, *Oil industry, *Rotary drilling, Equipment, Drilling fluids, Muds, Rock mechanics, Rock properties.
Identifiers: *Rock drillability, *Drilling performance interpretation, Bit design, Bit performance, Performance line, Rotary speed, Laboratory drilling.

Rotary drilling is an anachronism. It stands as the last remaining art in an industry where virtually all other operations have been reduced to a science. A single link remains to be forged before drilling also can elevate itself to scientific status. That vital link is a thorough understanding of what happens on the bottom of the hole as the bit rolls over it. This plan of action measures only a few square inches, but it is the location of the only 'useful' work performed in drilling. This manual relates rotary drilling to rock strength, or rock drillability. The aim of establishing such a relation is to allow prediction of the behavior of a drill bit from one well to the next. To accomplish this objective mathematical equations must be derived which describe the interaction of bit and rock. The author firmly believes that equations can be written to describe and predict drilling in the field. More than 26 variables have been identified which influence drilling. Without understanding their effects, maximum drilling efficiency and minimum costs can never be reached. (Campbell, NWWA)
W71-05313

NEWS TOOLS AND PROCEDURES FOR BETTER DRILLING OPERATIONS,
Oil and Gas Journal, Tulsa, Okla.
For primary bibliographic entry see Field 08A.
W71-05316

EXPLOSIVES RESEARCH TO IMPROVE FLOW THROUGH LOW PERMEABILITY ROCK,
Bureau of Mines, Bartlesville, Okla.
For primary bibliographic entry see Field 08H.
W71-05322

8F. Concrete

MILD HYDRATION HEAT CEMENT FOR THE INGURSK ARCH DAM,
Bureau of Reclamation, Denver, Colo.
P. P. Tsulukidze, N. L. Monina, and Z. S. Avalyani.
Available from NTIS as PB-193 614T, $3.00 in paper copy, $0.95 in microfiche. Translated from: Gidrotekhnicheskoe Stroitel'stvo No 2, p 27-29, 1965. Bureau of Reclamation Translation No 681, Dec 1966. 11 p, 6 tab.

Descriptors: Concrete technology, *Heat of hydration, Cement, Portland cement, Arch dams, Concrete dams, Dam design, Design standards, Clinkers, Chemicals, Chemical engineering, Slags, Industrial plants, Laboratory tests, Minerals, Manufacturing, Hydraulic structures, *Low heat cement, Physical properties, Mechanical properties, Additives, Pozzolans, Fly ash, Specifications, Diatomites.
Identifiers: USSR, Ingursk Dam (USSR), *Exothermic process, Foreign research, Cement efficiencies.

The 4 million cu m of concrete for the 270-m-high Ingursk arch dam, being built in the Caucasus Mountains of the Georgian SSR, must meet very high standards as to deformation and strength (180-day strength of 35 kg/sq cm in tension and 400 in compression). Since none of the plants nearby produced cement of the required quality, especially for low-heat evolution, a program was initiated to develop a cement that would produce concrete of the required quality. Starting with the cements nearest to meeting the requirements, a special Ingursk hydrotechnical cement was developed by substitution of diatomite for a part of the clay component of the clinker, recalcination of the clinker, vibromilling after regular milling, and addition of fly ash. Tests showed that this cement with a coefficient of saturation of 0.84 could be classed as a low-heat cement and that it produced concrete with a compressive strength of 500 kg/sq cm. It was recommended for use in the Ingursk Dam.
W71-05253

8G. Materials

ASHALT DIAPHRAGMS FOR DAMS BUILT OF LOCAL MATERIALS,
Bureau of Reclamation, Denver, Colo.
S. N. Popchenko.
Available from NTIS as PB-193 663, $3.00 in paper copy, $0.95 in microfiche. Translated from: Gidrotekhnichesko Stroitel'stvo No 11, p 15-18,

1969. Bureau of Reclamation Translation No 835, March 1970. 11 p, 4 fig, 22 ref.
Identifiers: *Dams, *Bituminous coatings, *Diaphragms (Mechanics), Dams, Reviews, Leakage (Fluid), Control systems, Inland waterways, Construction, Plastics, Mobility, USSR, Seepage shielding materials, Translations.

Vertical, centrally located asphalt diaphragms in dams of local materials are more advantageous in the northern and high elevation regions: they cut down the volume of imported materials and render the work independent of the season. The success of asphalt diaphragms abroad recommends them for the Soviet Union. Their construction can be simplified by the use of poured asphalt-concrete, and they can be made more reliable by placing an asphalt layer along the axis of the diaphragm with the application of repair-electric heating.
W71-05250

WATER PROBLEMS IN OIL PRODUCTION,
For primary bibliographic entry see Field 05G.
W71-05295

CORROSION AND ITS CONTROL,
Oil and Gas Journal, Tulsa, Okla.
Marshall E. Parker.
Tulsa, Oklahoma, Oil and Gas Journal, 1960. 52 p.

Descriptors: *Corrosion, *Cathodic protection, *Oil industry, Damages, Electroysis, Oxidation, Rusting, Water pollution effects, Well casings, Well screens, Corrosion control, Anodes, Cathodes, Waterproofing.
Identifiers: *Corrosion hot spots, *Cathodic protection principles, Pipe-to-soil potentials, Attenuation curves, Magnesium anodes, Corrosion records, Protective metallic coatings, Corrosion of wells, Weld decay.

The subject of corrosion is a matter of prime concern to people engaged in plant and field operations dealing in the recovery and ultilization of liquid products from oil to ground water, including toxic chemicals. There are a number of anti-corrosion methods available, and there are thousands of individual details which make up the literature and techniques on this subject. Some of these methods are more appropriate under specific conditions than others. Great care is recommended for the selection of the means to be used in a given situation. Once the selection is made, careful attention must be paid to proper application of the method. This operating manual gives, in a series of easy-to-read, one page installments, a large variety of technical information, and helpful pointers in the field of corrosion. (Campbell-NWWA)
W71-05315

WATER WELL INCREASING COSTS OF INSTALLATION AND MAINTENANCE,
Layne Texas Co., Houston, Tex.
F. Dorr, Jr., and A. L. Williams, Jr.
Layne Deep Waters, Vol 3, No 2, p 2-5, June 1968. 8 fig.

Descriptors: *Water wells, *Installation costs, *Corrosion, Initial costs, Equipment, Cathodic protection, Electrolysis, Well screens, Casing.
Identifiers: *Corrosion control theory, *Water system corrosion control, Galvanic corrosion.

The increasing cost of materials and labor has proportionally influenced the cost of water wells. Therefore, extending the service life of a water well has become an increasing factor in the sale of new wells as well as the work-over of existing wells. In an investigation by the Layne Texas Company, the corrosion attack on wells was found to be perhaps the most significant factor of a well's failure. The investigation determined that the corrosion could be mitigated or completely stopped through the application of specifically designed materials. The corrosion of the buried metals of a well is related to the flow of direct electrical current from the metal into the adjacent soil or water. The current flow causes a chemical change in the metal, and results in particles of metal being carried away....corrosion. Preventative measures are discussed. (Campbell-NWWA)
W71-05319

8H. Rapid Excavation

MODEL OF HYDROLOGIC REDISTRIBUTION OF RADIONUCLIDES AROUND NUCLEAR-EXCAVATED SEA-LEVEL CANALS,
Isotopes, Inc., Palo Alto, Calif. Palo Alto Labs.
For primary bibliographic entry see Field 05B.
W71-04882

EXPLOSIVES RESEARCH TO IMPROVE FLOW THROUGH LOW PERMEABILITY ROCK,
Bureau of Mines, Bartlesville, Okla.
J. L. Eakin, and J. S. Miller.
Society of Petroleum Engineers of AIME, Preprint No SPE-1715 1966. 10 p, 16 ref.

Descriptors: *Hydraulics, *Aquifers, Rock mechanics, *Water wells, Rock properties, Transmissivity, Chemical reactions.
Identifiers: *Hydraulic fracturing, *Explosive research, *Rock-blasting mechanism, Explosive research center, Down hole camera.

Small-scale surface tests were conducted to determine the feasibility of using a nitroglycerin base explosive for rock fracture expansion. Preliminary underground testing, surface and near-surface tests with liquid explosives showed that explosives in sheet-like layers simulating underground fracture would detonate and propagate through the layer. The successful surface tests used layers of explosive confined between glass plates and explosive-saturated sand confined in small diameter metal tube. In addition, it was shown that explosion propagated through the pores of Berea sandstone saturated with a liquid explosive. Encouraging results were produced by a shallow test in which extensive fracturing was effected by the detonation of 5 3/4 qt of NGl (nitroglycerin) in a vertical crack 5 ft long, 5 ft deep, and 0.1 in. wide in limestone. Fractures 1/4 to 2 in. wide extended 120 ft through the detonation hole. A 50-qt charge of NGl was dynamited placed into a permeable zone at a depth of 42 ft in Green River oil shale. The explosion propagated to test holes drilled on 12 to 15-ft spacing. Effects of the explosion were observed by coring, Caliper logs, Downhole Camera surveys, elevation measurements and air-flow tests. Fracture improvement ratios on 8 test holes, determined from before and after flow tests, ranged from 2.3 to 19.1 and averaged 8.0. (Campbell-NWWA)
W71-05322

10. SCIENTIFIC AND TECHNICAL INFORMATION

AIR POLLUTANTS AFFECTING THE PERFORMANCE OF DOMESTIC ANIMALS - A LITERATURE REVIEW.
Agriculture Research Service, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-04910

PERCEPTION OF WATER RESOURCE INFORMATION SOURCES AND EDUCATIONAL NEEDS BY LOCAL OFFICIALS AND SPECIAL INTEREST GROUPS,
North Carolina State Univ., Raleigh. Dept. of Adult and Community Coll. Education; and North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 06B.
W71-04933

POTENTIAL ALGICIDES FOR THE CONTROL OF ALGAE,
Los Angeles County Sanitation District, Calif.
For primary bibliographic entry see Field 05G.
W71-05083

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DESCRIPTION AND EVOLUTION OF SNOW AND ICE FEATURES AND SNOW SURFACE FORMS ON THE KASKAWULSH GLACIER,
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KORROLL V BOARD OF TRUSTEES OF SCHOOL DISTRICT 24 (BOUNDARY DISPUTE UNDER DESCRIPTION EXTENDING TITLE TO BANK OF LAKE).
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A COMPARISON OF THE TOXICITY OF SOME COMMON INDUSTRIAL WASTE COMPONENTS TESTED INDIVIDUALLY AND COMBINED,
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U. S. GOVERNMENT PRINTING OFFICE : 1971 O - LT - 432-320 (19)

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Water Quality Office of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.

Subject Fields

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- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 11
JUNE 1, 1971

W71-05335 -- W71-05835

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 11
JUNE 1, 1971

W71-05335 -- W71-05835

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

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Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

B. Aqueous Solutions and Suspensions

)LYWATER AND POLYPOLLUTANTS,
rkbeck Coll., London (England). Dept. of ystallography.
Barnes, I. Cherry, J. L. Finney, and S. Petersen.
ature, Vol 230, No 5288, p 31-33, March 5, 71. 3 p, 26 ref.

escriptors: *Gels, *Water types, *Water proper-s, *Water chemistry, Laboratory tests, ethodology, Investigations, Pollutants, Silica, ondensation, Aqueous solutions, Water structure. entifiers: *Anomalous water, *Polywater.

me careful experiments and a close look at the erature of polywater give no reason to believe at any new phenomenon has been discovered. ntamination could account for the observed ef-cts. The degrees of anomality in the samples alyzed were determined chiefly from observa-ns on the phase separation effects, the gel-like idue obtained after evaporation, and the shape the density-temperature curve obtained after rtain corrections had been made for the effect of narrow capillary bore. The method of produc-n was continually refined so as to eliminate as ny sources of contamination as possible. It was ncluded that the most common sources of con-nination in the general production of anomalous ter are as follows: (1) Gross salt contamination, surface migration and/or vapor transport, when t solution methods of production are used, (2) pillary residues (nitrogenous or silicaceous) ulting from the capillary 'cleaning' process, (3) aching out of the intrinsic glass components (sil-n and sodium) from the capillary walls, and (4) rface migration and vapor transport of contami-nts inherent in the apparatus. (Woodard-USGS) 71-05346

FFUSIVITY OF OXYGEN IN AQUEOUS ECTROLYTE SOLUTIONS,
burn Univ., Ala. Dept. of Chemistry.
orge Wen-Chi Hung.
D Thesis, June 9, 1970. 142 p, 24 fig, 35 tab, 76 . OWRR Projects A-013-ALA (2), A-007-ALA), and A-018-ALA (1).

scriptors: *Diffusivity, *Dissolved oxygen, lectrolytes, *Aqueous solutions, Diffusion, ter chemistry, Chemical reactions, Oxidation, exchange, Biochemistry, Oxygen.
ntifiers: *Oxygen diffusion.

e diffusivity of dissolved oxygen in aqueous elec-lyte solutions was measured over an extended ncentration range of the electrolytes. Sodium n-cylsulfonate, sodium 2, 4-dimethylbenzenesul-ate, sodium p-dodecylbenzenesulfonate, sodium oride, sodium sulfate, and sodium phosphate re used in this investigation. The concentration ge of the electrolytes extended to 2000 ppm for three sulfonates, 2 M for the chloride, 0.9 M for sulfate and 0.05 M for the phosphate. The dif-ion coefficients of dissolved oxygen in all six tems varied with the concentration of elec-lytes. The ratio of the diffusion coefficient of solved oxygen in electrolyte solutions to that in e water is linear with respect to the square root electrolyte concentrations for the chloride and sphate solutions and for the dilute solutions of 4-dimethylbenzenesulfonate and p-dodecyl-zenesulfonate; sulfate and n-decylsulfonate utions do not demonstrate this linear behavior. e results are discussed in terms of Eyring's 'hole' ory for diffusion and viscous flow processes, and Stokes-Einstein model for diffusivity and cosity. (Knapp-USGS)
71-05454

DIFFUSION COEFFICIENT OF SILICA IN SEA-WATER,
Brussels Univ. (Belgium). Industrial Chemistry Lab.; and Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02K.
W71-05595

MERCURY ADSORPTION OF CHROMIUM OXIDE GELS,
Brunel Univ., Uxbridge (England). Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W71-05598

ANOMALOUS WATER NOT POLYWATER,
Unilever Ltd., Port Sunlight (England). Unilever Research Lab.
B. A. Pethica, W. K. Thompson, and W. T. Pike.
Nature Physical Science, Vol 229, No 1, p 21-22, January 4, 1971. 2 p, 9 ref.

Descriptors: *Water types, *Water properties, *Water sources, Gels, Investigations, Methodology, Testing, Test procedures, Spectrometers, Laboratory tests, Water chemistry, Silica.
Identifiers: *Anomalous water, *Polywater, Mass spectrometer.

A number of workers have shown that there is good reason to doubt that anomalous water can be regarded as a single substance. A plausible scheme for the formation of silica sols has been outlined. The high refractive index of concentrated anomalous water reported could well be ascribed to a silicate. Supporting this view are the further results of the mass spectra examination of anomalous water. The mass spectrometric data are particularly important because of claims that anomalous water can be distilled and thus freed from involatile impurities. Repeated investigations of anomalous water on an AEI MS 902 mass spectrometer, however, with both a micro glass inlet system and direct insertion techniques under a variety of instrumental conditions (for example, low ionizing voltage, varied source temperatures) have failed to show any such ions. Considering these findings, we feel strongly that anomalous water is not polywater, and until conclusive evidence to the contrary is obtained the possibility still exists that it is a gel or solution of silicates or other materials. (Woodard-USGS)
W71-05599

MICROWAVE DIELECTRIC MEASUREMENTS ON ANOMALOUS WATER,
Cold Regions Research and Engineering Lab., Hanover, N.H. and Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
P. Hoekstra, G. Swinzow, S. Ackley, and W. T. Doyle.
Nature Physical Science, Vol 229, No 3, p 92-94, January 18, 1971. 3 p, 3 fig, 1 tab, 16 ref.

Descriptors: *Water chemistry, *Gels, *Condensation, *Water types, *Water properties, Research equipment, Methodology, Test procedures, Investigations, Laboratory tests, Electrical properties.
Identifiers: *Anomalous water, *Capillaries, Pyrex capillary tubing.

As part of a continuing investigation of the properties of water adsorbed on silicate surfaces, an analysis of the dielectric and thermochemical properties of the anomalous water substance formed in glass capillaries in such conditions was made. Capillaries were drawn from thick-walled 'Pyrex' capillary tubing (6 to 7 mm outer diameter, 3/4 to 1-1/4 mm inner diameter) by heating the glass in a flame of natural gas and oxygen. Columns of liquid were formed in approximately5% of the capillaries exposed. In most cases liquid columns did not exceed 1 to 2 mm in length; a few columns were longer than 5 mm. Often one capillary contained more than one column. A correlation was found between the dilatometric and dielectric behavior of anomalous water grown in small glass capillaries. Samples that exhibited the anomalous thermal behavior reported by other investigators showed normal dielectric behavior; samples that did not freeze when repeatedly cooled to -60 deg C had a dielectric constant and a dielectric loss less than those of normal water. (Woodard-USGS)
W71-05602

SALT EFFECTS IN AQUEOUS SOLUTIONS OF UREA,
For primary bibliographic entry see Field 02K.
W71-05618

02. WATER CYCLE

2A. General

A LABORATORY CATCHMENT AND ASSOCIATED INSTRUMENTATION,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
K. C. Das, and L. F. Huggins.
Paper No 70-530 presented at 1970 Annual Meeting of American Society of Agricultural Engineers, Minneapolis, Minnesota, July 7-10, 1970. 20 p, 8 fig, 1 tab, 18 ref. OWRR Project B-016-IND (1).

Descriptors: *Overland flow, *Rainfall-runoff relationships, *Hydraulic models, Model studies, Analog computers, Simulated rainfall, Hydraulic similitude, Data collections, Data processing, Instrumentation.
Identifiers: Laboratory watersheds, Watershed models.

To study in the laboratory the rainfall-runoff relationship, an experimental watershed consists of a rainfall similator, flow plane, pressure transducer to measure the depth of water on the flow plane, weighing device to measure the accumulated volume and rate of runoff, and a vertical force measuring device to determine the detention volume on the catchment. The transducer signals are sent from the laboratory to a remote analog computer where the signals are amplified and analyzed before recording on magnetic tape. Initital test results indicate that such data can be acquired with good precision and that an on-line analysis capability greatly expands the scope of feasible experiments. (Knapp-USGS)
W71-05353

ROLE OF INFILTRATION IN NONLINEAR WATERSHED ANALYSIS PROCESSES,
California Univ., Davis. Dept. of Water Science and Engineering.
J. Amorocho.
American Society of Agricultural Engineers Transactions, Vol 10, No 3, p 396-399, 404, 1967. 5 p, 7 fig, 13 ref. OWRR Project B-005-CAL (8).

Descriptors: *Infiltration, *Surface-groundwater relations, *Watersheds (Basins), *Model studies, Equations, Precipitation (Atmospheric), Vegetation, Hydrology, Hydrologic cycle, Evaporation, Soil moisture, Streamflow, Low flow, Groundwater movement, Water storage, Runoff, Sorption, Permeability.

If the ground surface of a watershed is viewed as the locus of the points of application of the net input to a hydrologic system (gross precipitation over the vegetative canopy minus interception), infiltration is then the first major branching process whereby the system becomes divided into two principal components: (1) a subsystem involving surface storage and translation elements and (2) a subsystem with groundwater storage and translation elements. Two principal types of equivalent systems have been proposed for the representation of the hydrologic cycle. One is the result of what has been termed 'hydrologic synthesis,' and the

other results from 'nonlinear functional analysis.' In synthesis, a group of components representing major watershed mechanisms are linked in such a way that they operate by cascading and branching in some logical fashion in order to convert the input into an output approximating the measured outflow of the prototype. Each one of the components has a known structure and its parameters are adjusted and optimized so that a resonable matching between predicted and recorded outflows results. With the general structure of the synthetic models of the hydrologic cycle established, questions relative to the differences between the infiltration components of the models and the prototype are examined. (Woodard-USGS)
W71-05354

REPRESENTATIVE BASINS OF NEW ZEALAND-1970.
Ministry of Works, Wellington (New Zealand). Water and Soil Div.

New Zealand Ministry of Works, Water and Soil Division Miscellaneous Hydrological Publication No 7, 1970. 291 p, 3 fig, 16 ref.

Descriptors: *Water resources, *Hydrologic data, *International Hydrological Decade, *Surface waters, *Rainfall-runoff relationships, Geology, Streamflow, Topography, Vegetation, Land use, Data collections, Instrumentation, Stream gages, Soil moisture, Planning, Model studies, Maps, Watersheds (Basins).
Identifiers: *New Zealand.

This publication has been produced as part of New Zealand's contribution to the International Hydrological Decade, 1964-75. The selection of representative basins in New Zealand is based on the fundamental assumption that each individual basin is representative of its hydrological region and that the areas of the basins would be uniformly distributed between the desirable limitations of 1 and 250 square kilometers. This distribution of areas is of particular value in hydrological prediction studies, which use data from part of or the entire network. It is unlikely that any one basin is representative of all the hydrological characteristics of its region; in general it will represent the most dominant features. For instance, in the Hokianga region, where a low-flow-recession study has shown the extreme variability of the recession constants (0.47-0.95), the soil type in all catchments is the same (podzolic clays), but the lithology is variable because of the presence of volcanic outcrops. It appears that surface flows are also similar within the region. Representativeness for low flows has been tested on a large scale in Northland in the course of a water resources investigation. High-flow correlations between gaging stations in the same catchment or in adjacent catchments to establish missing stage records are presented. The text descriptions accompanying each basin map follow the pattern recommended by UNESCO. (Woodard-USGS)
W71-05448

WATER RESOURCES - APPENDIX V OF COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY,
Pacific Northwest River Basins Commission, Vancouver, Wash.
G. L. Bodhaine, H. D. Hafterson, M. J. Mundorff, and John Summersett.
April 1970. Vol 1 (Subregion 1-6), p 1-543; Vol 2 (Subregion 7-12), p 544-1022. 897 fig, 497 tab, 206 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Hydrologic data, *Pacific Northwest U.S., Water quality, Hydrology, Meteorological data, Climatology, Water rights, Water management (Applied), Water utilization, Consumptive use, Streamflow, Flow rates, Discharge measurement, Runoff, Aquifers, Water yield, Chemical analysis, Topography, Hydrographs, Water temperature, Sediment transport, Sediment yield
Identifiers: *Water resources Index (Pacific Northwest).

This appendix, prepared under the auspices of the Pacific Northwest River Basins Commission, is one of a series of 16 making up the complete Columbia-North Pacific Region Framework Study on water and related lands. The water resources segment of the study is presented in two volumes as appendex V. Volume 1 includes subregions 1-6 (the eastern sections of the North Pacific region study), and volume 2 includes subregions 7-12 (the western sections of the region). The study consists primarily of summarization, analysis, and extension of existing data on water resources (both surface and groundwater) of the region. The base period selected is 1929-58. The discharges used throughout generally reflect 1970 or 1975 conditions of development; that is, the natural flows have been depleted and regulated for those anticipated levels of use. The quantity and quality of water available in each subregion is shown on graphs and in tables. Data on sediment and temperature also are included. Each subregion report also contains a general hydrologic description of the area; a fairly detailed description of the climate; and discussions of water use, stream management, and water rights. In addition, the Regional Summary includes sections covering technological advancements and areas of need for additional hydrologic data. (Woodard-USGS)
W71-05449

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 02H.
W71-05450

EFFECT OF WATERSHED CHARACTERISTICS ON THE TIME PARAMETERS OF RUNOFF HYDROGRAPHS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
Pinhas Golany.
PhD Thesis, August 1970. 201 p, 48 fig, 38 tab, 45 ref, 2 append. OWRR Project B-007-MINN (4).

Descriptors: *Rainfall-runoff relationships, *Hydrograph analysis, *Systems analysis, *Model studies, *Streamflow, Runoff, Watersheds (Basins), Equilibrium, Runoff forecasting, Flow rates, Channel morphology, Topography, Mathematical studies, Equations, Computer programs, Mathematical models, Routing, Unsteady flow.
Identifiers: *Watershed characteristics, *Streamflow equilibrium (Time).

Physical characteristics of small watersheds in southeastern Minnesota were used to develop a mathematical model for the study of the effect of watershed characteristics on the time required for the rate of runoff at the outlet of the watershed to become equal to the supply rate. A theoretical equation is compared with an empirical equation. This is defined as 'time to virtual equilibrium'. It was concluded that the time to virtual equilibrium of a watershed is best determined as a sum of two parameters. One is the time to virtual equilibrium of the watershed, including the overland flow. The second is the channel rise time, defined as the time elapsed from time to virtual equilibrium of the elementary watershed to time to virtual equilibrium of the watershed at the outlet. The channel rise time increases with the size of the watershed. The travel time can be used to determine the channel rise time since both time parameters are functions of the same physical characteristics of the watershed, namely, the drainage area, the channel length, roughness, slope and cross section geometry. (Woodard-USGS)
W71-05452

MOUNTAIN RUNOFF AND ITS RELATION TO PRECIPITATION, GROUNDWATER, AND

RECHARGE TO THE CARBONATE AQ OF NITTANY VALLEY, PENNSYLVANI
Pennsylvania State Univ., University Park. Geology and Geophysics.
Leonard Franklin Konikow.
MS Thesis, Pennsylvania State University, for Research on Land and Water Resource 1969. 128 p, 27 fig, 5 tab, 26 ref, 3 append Project A-005-PA (1).

Descriptors: *Surface-groundwater relat *Karst, *Recharge, *Pennsylvania, C rocks, Aquifers, Rainfall-runoff relat Hydrogeology, Hydrology, Groundwate ment, Water balance, Hydrologic budget tion, Sinks.
Identifiers: Nittany Valley (Penn).

The relations between mountain runoff, p tion, and changes in groundwater storage culated for the Nittany Valley of Penn This required an estimate of gravity yield surements of groundwater stage. The gravity yield of the shale and sandstone fo beneath the ridges of Nittany and Tusse tains was found to average about 1.5%. Th yield of the colluvium, which covers much ridges, is about 6%. In the Pine Grove M the variation of gravity yield with time ridingly controlled by its relation to mean water stage because of the great diffe porosity between the colluvium and Mountain runoff from shale and sandsto was flashy, while Spring Creek in a carbo area showed comparatively small fluctu discharge. Mountain streams flowing thro may completely or partially sink upon cro carbonates. (Knapp-USGS)
W71-05560

EVIDENCE FOR A DEEP WESTERN B RY CURRENT IN THE SOUTH OCEAN,
Woods Hole Oceanographic Institution, M
B. A. Warren.
Supported by Office of Naval Research Physical Science, Vol 229, No 1, p 18-19 4, 1971. 2 p, 7 ref.

Descriptors: *Ocean currents, *Ocean ci *Indian Ocean, Boundaries (Surfaces), M dies, Salinity, Depth, Velocity, Density Flow, Currents (Water), Water ci Stratified flow.
Identifiers: *South Indian Ocean, *Ocea dary currents.

Simple models of the deep ocean circulat southern hemisphere require narrow, r flowing currents along the western bour the great ocean basins to transport cold, tarctic water into low latitudes. The dee maximum found throughout the southe sphere lies at depths of 2,000-3,000 m in Indian Ocean, well above our assumed lev meridional velocity. Because the salinity is formed through entrainment of North deep water in the circumpolar current, s must also enter the deep Indian Ocean south. The way in which this comes about tirely clear from the present two hydrogr tions. It happens that near Madagascar, a 2,000 m, the calculated values of r geostrophic velocity generally decrease w down to about the 3,000 m level, then again at great depth; the assumption velocity is zero at 3,000 m is then consis northward movement not only of the bott but also of the water of maximum (Woodard-USGS)
W71-05596

AN EXPERIMENT IN FINITE-DIFF WATERSHED MODELING,
Montana Univ., Boziman. Joint Water R Research Center.
Darrel E. Dunn.

Montana University Joint Water Resources Research Center Report No 13, July 1970, 14 p, 42 ref, 36 p computer program. OWRR Project A-034-MONT (2).

Descriptors: *Model studies, *Watersheds, *Simulation analysis, *Computers, *Testing, Hydrographs, Water storage, Vadose water, Groundwater, Statistical models, Data processing, Water resources.
Identifiers: *Phreatic zone, *Watershed simulation.

This report details an attempt to develop an accurate finite-difference watershed model. The watershed was simulated by dividing the watershed system into seven cells and then calculating water transport from cell to cell through successive time increases: surface runoff, vadose zone, water table, fluctuating phreatic zone, remainder of phreatic zone, and a cell layer on the bottom and on the top for computational convenience. Cells are formed by dividing each layer by a grid into three-dimensional parallel pipeds, and then weather data are added. From this setup, any type of water storage in the system can be calculated, as well as stream hydrographs. The model was tested by attempted simulation of the Bridger Creek Watershed near Bozeman, Montana. The model failed to simulate this watershed with accuracy, and the error was so great that further testing was not attempted. A fairly large amount of computer time was used on an XDS Sigma 7 computer. It was felt that a basic deficiency of this model is lack of a cell layer to represent the upper, more permeable part of the phreatic zone. The computer program is appended to the report. (Yensen-Arizona)
W71-05701

SIMULATION VIA TIME-PARTITIONED LINEAR PROGRAMMING: A GROUND AND SURFACE WATER ALLOCATION MODEL FOR THE GALLATIN VALLEY OF MONTANA,
Montana State Univ., Bozeman. Dept. of Agricultural Economics.
Donald William Boyd.
Ph d thesis. Montana University Joint Water Resources Research Center Report No 10, June 1968. 217 p, 7 fig, 10 tab, 3 append, bibliography. OWRR Project B-029 MONT (1).

Descriptors: *Model studies, *Water shortage, *Surface-groundwater relationships, *Montana, *Economics, Irrigation, Water supply, Water demand, Irrigation water, Saturated soils, Groundwater, Water table, Computer models, Streamflow, Water users, Water utilization, Recharge, Water distribution (Applied), Data collections, Streamflow forecasting, River flow.
Identifiers: *Gallatin Valley of Montana, Gallatin River of Montana.

The Gallatin Valley, Montana, usually has water shortage only at the peak irrigation season, complicated by a rising water table caused by irrigation at the lower end of the valley. This rising water table removes land from production. The area has vast potential groundwater reserves but interbasin transfer is impracticable. The author reviews the history of the water shortage, previous studies of the problem, and the need for a model. He then details how a model was selected and derived. The model was validated against 30-year records of streamflow, with a 20 per cent error observed. The model was judged accurate enough to simulate groundwater pumping, interbasin transfer, and recharge. Economic values were then calculated, and a value sensitivity analysis made to determine economic significance. The author concludes that the model realistically simulates the key features of the Gallatin Valley water system, including historical simulation, groundwater discharge, consumptive use, and optimal allocation. Groundwater development is the obvious solution to the water shortage and rising water table. Extensive appendices give yearly streamflow, precipitation, and groundwater data. (Yensen-Arizona)
W71-05716

2B. Precipitation

A HEATED ALPINE PRECIPITATION GAUGE,
Forest and Range Experiment Station, Rangiora (New Zealand).
For primary bibliographic entry see Field 07B.
W71-05363

MONTHLY PERSISTENCE PATTERNS OF AUCKLAND RAINFALL YIELDS,
Auckland Univ. (New Zealand). Dept. of Civil Engineering.
A. J. Raudkivi, and N. Lawgun.
Journal of Hydrology (New Zealand), Vol 9, No 1, p 29-31, 1970. 3 p, 2 tab, 2 ref.

Descriptors: Correlation analysis, *Rainfall, *Distribution patterns, Stochastic processes, Markov processes, Data collections, Meteorological data, Climatology.
Identifiers: *New Zealand.

A chi-square test was used to determine the persistence pattern of the monthly rainfall data obtained from Albert Park, Auckland, New Zealand. The results indicate the months for which the rainfall yields are affected by the amounts of rain of the immediately preceding month. Only three months of the year are affected by the immediately preceding month. These are March-April, July-August, November-December. It is interesting to note that the correlated pairs of months occur at equally spaced intervals, every 4 months. Thus by the serial correlation coefficient the persistence effect is insignificant, whereas the test indicates strong persistence effects between certain pairs of months of the year. This persistence pattern could be an important factor in some hydrological studies, for example in simulation of monthly rainfall data for water resources studies. (Knapp-USGS)
W71-05364

A GENETIC APPROACH TO CLIMATIC CLASSIFICATION,
Columbia Univ., New York. Dept. of Geography.
John E. Oliver.
Annals, Association of American Geographers, Vol 60, No 4, p 615-637, December 1970. 22 fig, 2 tab, 17 ref.

Descriptors: *Air masses, *Climatic zones, *Model studies, *Classification, *Synoptic analysis, Mapping, Arid lands, Seasonal, Precipitation (Atmospheric), Temperature, Humidity, Data collections, Climatic data, Meteorological data.
Identifiers: *Climatic classification, *Thermohyets, *Australia.

Because climatic systems have largely been approached as summations of annual temperature and precipitation values, a close, dynamic relationship between climate and related physical systems has never been clearly established. Once identified, an air mass can be interpreted in terms of temperature, humidity, stability characteristics and probable precipitation yield. A genetic approach to climatic classification was therefore devised using an air mass model whose transitional character is necessarily aligned to the transitional distribution of other natural systems, such as vegetative, pedogenic and geomorphic regimes. Set-theoretic diagrams were devised, representing 5 basic air mass designations, polar, tropical, equatorial, maritime and continental. Three basic climatic regimes are distinguished: (1) dominant, in which a single air mass dominates all year, (2) seasonal, in which 2 air masses are seasonally dominant (3) compound, which are influenced by more than 2 air masses during the year or in which no dominant air mass is distinguishable. A 3-directional matrix showing variations between dominant regimes suggests that compound regimes are transitions from one seasonal regime to another. A table is presented showing the determination of differing climates within regimes by air mass types. Air masses are differentiated on the basis of mean surface temperatures and specific humidity values. Monthly air mass dominance is determined by analysis of surface station data. Constructions of modified climographs, thermohygric diagrams and monthly air mass identification charts (MAMI) are described. Data from 90 Australian weather stations were used to test air mass differention using MAMI charts. Seasonally dominant air masses and their migrations were clearly shown. (Casey-Arizona)
W71-05476

THE NORTH AFRICAN FLOOD DISASTER, SEPTEMBER 1969,
Anti-Locust Research Centre, London (England).
D. Winstanley.
Weather, Vol 25, No 9, p 390-403, September 1970. 7 fig, 1 tab, 13 ref.

Descriptors: *Cyclones, *Precipitation (Atmospheric), *Fronts (Atmospheric), *Winds, Historic flood, Flood damage, Rainfall, Weather patterns, Weather data, Climatic data, Storm structure, Air circulation, Air masses, Air temperature, Boundary processes, Precipitation excess, Depression storage, Mountains, Impact (Rainfall), Synoptic analysis, Marine air masses, Floods, Thermocline, Atmosphere.
Identifiers: *North Africa, *Cyclogenesis, Desert Locusts, Mediterranean.

On 23 September, 1969, a cyclonic storm developed over the central Mediterranean, which moved westward over the next few days, across northwestern Libya and southern Tunisia, before finally dissipating over northeastern Tunisia. The resulting tolls in property and human lives were unprecedented. The accompanying rains even facilitated an unprecedented Desert Locust population explosion through the following winter and spring. Data from a great number of weather stations in the Mediterranean area were collected and analyzed for the factors involved in the genesis of the cyclone. The September monthly rainfall total at Biskra, Algeria, was 299.2 mm, compared to a previous record of 124.0 mm. A sequence of 1200 GMT surface charts indicate the main surface feature was the development of a Saharan depression over northern Algeria, which resulted from the anchoring of a lee depression by the Atlas mountains moving slowly northeastward until it was forced south by cool air. The Saharan depression finally moved out over the Mediterranean while other surface conditions which contribute to cyclone formation, were developing. Over northern Algeria and Morocco, the usual large temperature difference between the Mediterranean coast and the desert was enhanced by the orographic barrier. In addition to surface effects, and differential heating, flow is analyzed at different trophospheric levels, and cyclonic conditions are analyzed in terms of large-scale atmospheric flow patterns within which more local changes are taking place. (Casey-Arizona)
W71-05484

CATCHMENT EVAPORATION AND POTENTIAL EVAPORATION-FURTHER DEVELOPMENT OF A CLIMATOLOGIC RELATIONSHIP,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02D.
W71-05588

CONVERGENCE ZONES IN SOUTHER CALIFORNIA,
Weather Bureau, Los Angeles, Calif.
J. H. Aldrich.
Weather, Vol 25, No 4, p 140-146, April 1970. 3 fig, 5 ref.

Descriptors: *Winds, *Climatic zones, *Sea breezes, *Air masses, *Fronts (Atmospheric), Air circulation, Air temperature, Atmosphere, Boundary processes, Air-water interfaces, Air environment, Environmental effects, Mode of action,

California, Arid lands, Climatology, Clouds, Humidity, Weather patterns, Wind pressure, Shear, Air pollution, Temperature, Precipitation (Atmospheric), Arizona, Wind velocity.
Identifiers: *Convergence zones, *Shear lines, *Wind shear, *Temperature inversions.

The lifting forces of the atmosphere which create soaring conditions for birds and gliders are created by forcing excess air upward. A shear line is a line or narrow zone across which there is an abrupt change in the horizontal wind velocity parallel to this line. Convergence involves an accumulation of air mass leading to vertical motion which limits the amount of excess air. A convergence line is a horizontal non-frontral line along which horizontal air has a maximum convergence. The best known form of shear line is that formed by a sea breeze. Solar heating and rising warm air over land create a convergent flow at the cooler sea breeze front, which usually produces lift and a shear line between the sea air and the land air. Passing storms, low-level temperature inversions and high mountains may all complicate this phenomenon. In Southern California a temperature inversion above the cool sea air and varied patterns of coastal hills and high mountain ranges produce very complex results. Some sea air does rise several thousand feet to flow through mountain passes into the desert. The San Fernando Convergence Zone, the Elsinore shear line, the El Mirage Shear over the Mojave Desert and the Tehachapi shear are all situations produced by factors complicating sea and mountain breezes. Another type of convergence zone occurs over the southwest U.S. when moisture-laden southeastern currents converge over Arizona with a drier flow from Southern California, creating abundant cumulus clouds and thunderstorms over the lower Colorado River Valley. (Casey-Arizona)
W71-05710

2C. Snow, Ice, and Frost

GLACIAL GEOLOGY OF THE CHAMPLAIN VALLEY: 1966-1970,
Vermont Univ., Burlington. Dept. of Geology.
W. Philip Wagner.
Available from NTIS as PB-197 882, $3.00 in paper copy, $0.95 in microfiche. Vermont University Water Resources Research Center Completion Report, February 1971. 11 p, 3 fig, 9 ref. OWRR Project A-006-VT (2).

Descriptors: *Hydrogeology, *Glacial drift, *Vermont, Lakes, Alluvium, Deltas, Sands, Gravels, Aquifers, Water yield, Geology, Water resources development, Paleohydrology, Sediments, Geohydrologic units
Identifiers: *Lake Champlain, *Champlain Valley (Vt).

Detailed study of the distribution of surficial materials in the Champlain Valley, Vermont, established a framework for the glacial history and provided basic information relevant to water supply, waste disposal, and sand and gravel resources. Postglacial modifications of the glaciated landscape include stream incision of up to several hundred feet, deposition of stream alluvium, and progressive submergence of southern portions of the Lake Champlain basin due to isostatic uplift of the spillway to the St. Lawrence River. High yield water supplies from surficial materials is limited to alluvium but quantities sufficient for domestic supplies are available in most places. Septic systems and sanitary landfills are probably most favorably accommodated by delta sands and gravels. Sand and gravel supplies are provided by ice marginal deposits and upland deltas. (Knapp-USGS)
W71-05337

SNOW SURVEY TECHNIQUES IN THE WAITAKI CATCHMENT, SOUTH CANTERBURY,
Ministry of Works, Timaru (New Zealand).
T. J. H. Chinn.
Journal of Hydrology (New Zealand), Vol 8, No 2, p 68-76, 1969. 9 p, 3 fig, 6 ref.

Descriptors: *Snow surveys, *Sampling, *Runoff forecasting, Glaciers, Snowpacks, Snow management, Precipitation gages, Water yield.
Identifiers: *New Zealand.

A brief outline is given of observations being made on seasonal snow at snow courses in the Waitaki catchment and the Tasman Glacier, New Zealand. Sampling difficulties are often caused by ice lmelting of ice layers also creates difficulties in interpreting summer samples. To overcome this problem without digging pits, a circular shaft, constructed of corrugated iron, was installed on the Tasman Glacier. This enables snow layers to be marked and sampled at any depth within the shaft. Loss of records has often occurred because sampling-site marker poles have been overtopped or broken by strong winds; poles consisting of lengths of PVC piping supported by one guy wire have been found partially successful in preventing this. (Knapp-USGS)
W71-05355

STUDIES OF SNOW CHARACTERISTICS IN THE NORTH-EASTERN BEN OHAU MOUNTAINS, NEW ZEALAND,
Department of Scientific and Industrial Research, Lincoln (New Zealand). Grasslands Div.
A. C. Archer.
Journal of Hydrology (New Zealand), Vol 9, No 1, p 4-21, 1970. 18 p, 9 fig, 6 tab, 13 ref.

Descriptors: *Snowpacks, *Snow surveys, *Water yield, *Snowmelt, Regression analysis, Runoff forecasting, Ablation, Temperature, Regimen, Weather, Meteorology.
Identifiers: *New Zealand).

Seasonal snow characteristics were studied during the winter and spring of 1966 and 1967 in the subalpine and alpine zones of the northeastern Ben Ohau Range, New Zealand. Five snow courses were established at altitudes of 3,200 ft, 4,100 ft, 5,000 ft, and 5,400 ft. Snow depths, snow density and water equivalents were measured along each snow course. A positive linear regression was established of increasing water equivalents with altitude. Temperatures were also recorded 16 in. above ground surface at 3,200 ft, 4,100 ft, and 5,000 ft, and an index of snow melt was compiled at 5,000 ft from screen temperatures and ablation rates. Characteristic slow net accumulation and rapid ablation are discussed in relation to weather phenomena. (Knapp-USGS)
W71-05362

A HEATED ALPINE PRECIPITATION GAUGE,
Forest and Range Experiment Station, Rangiora (New Zealand).
For primary bibliographic entry see Field 07B.
W71-05363

ESTIMATE OF GLACIERS SECULAR (1948-1966) VOLUMETRIC CHANGE AND ITS CONTRIBUTION TO THE DISCHARGE IN THE UPPER NORTH SASKATCHEWAN RIVER BASIN,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
W. F. S. Henoch.
Journal of Hydrology, Vol 12, No 2, p 145-160, January 1971. 16 p, 7 fig, 3 tab, 27 ref.

Descriptors: *Glaciers, *Ablation, *Regimen, *Water yield, Discharge (Water), Surveys, Data collections, Hydrologic data, Melting, Water storage, Climatology, Climatic data.
Identifiers: *North Saskatchewan River (Canada), *Glacier recession (Canada).

The recent trend of glacier recession in the Rocky Mountains began in the late 19th century. Since that time numerous studies of glaciers have been made but estimates of glacier volume decrease and the resultant increase in river discharge are lacking. Quantitative measurements show that glacier volume loss in the Upper North Saskatchewan River Basin during the period 1948-1966 was 1 cu km. This is approximately 4% of the total discharge determined from the records of the hydrometric stations at Saskatchewan Crossing and Mistaya River. (Knapp-USGS)
W71-05593

RHEOLOGICAL PROPERTIES AND BEARING CAPACITY OF FROZEN SOILS,
S. S. Vyalov.
Trans from Russian. Available from NTIS as AD-481 856, $3.00 in paper copy, $0.95 in microfiche. Cold Regions Research and Engineering Lab., Hanover, NH. Translation 74, Sept 1965. 219 p.
Identifiers: *Soil mechanics, Physical properties, *Soils, Cold weather tests, USSR, Loading (Mechanics), Deformation, Compressive properties, Plasticity, Failure (Mechanics), Fracture (Mechanics), Penetration, Buckling (Mechanics), Sand, Silt, Ice, Melting, Shear stresses, Water, Mud, Foundations (Structures), Permafrost, Stability, Arctic regions, Translations.

The rheological properties of frozen soil caused by the presence of ice and non-frozen water are important factors, without consideration of which calculations of the stability and steadiness of frozen soil are not possible. In the present work certain principles of rheology and the stability of frozen soil were examined, and proceeding from these principles an evaluation of the bearing capacity of natural footings and artificial pile foundations was made.
W71-05671

2D. Evaporation and Transpiration

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 02H.
W71-05450

THE EFFECT OF ANTITRANSPIRANT MATERIALS ON THE RADIATION BALANCE AND EVAPORTANSPIRATION IN AN IRRIGATED ALFALFA FIELD, ADDENDUM TO FINAL REPORT,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
Thomas A. Hales.
Horticulture Progress Report 83, December 1970. 180 p, 42 fig, 33 tab, 61 ref, 3 append. OWRR Project A-001-NEB (9).

Descriptors: *Evapotranspiration control, *Nebraska, *Alfalfa, *Chemcontrol, Water conservation, Water balance, Solar radiation, Irrigation, Water utilization, Consumptive use.
Identifiers: Atrazine, Antitranspirants.

A series of tests was carried out to test antitranspirants on 'Ranger' alfalfa in the Great Plains. Phenylmercuric acetate (PMA), Atrazine and Vatsol OT reduced transpiration but caused some foliar damage. Span 80 and Geon 652 reduced transpiration with no undesirable effects on plant growth. Replicated 3 m square plots were used to test various concentrations of PMA, Atrazine, Span 80 and Antifoamer A for effects on stomatal aperture, reflected solar radiation, net radiation, foliar production and soil moisture depletion. The PMA solutions increased leaf resistance as measured with a diffusion porometer. Neither PMA nor Antifoamer A affected net radiation, evapotranspiration, sensible heat flux or leaf temperature. Micrometeorological techniques used to measure the effectiveness of antitranspirant materials indicated no reduction in the evapotranspiration by field grown alfalfa at Mead, Nebraska. These experiments do not suggest any practical advantage to the use of antitranspirants on alfalfa in the central Great Plains. (Knapp-USGS)

/71-05453

OTENTIAL EVAPORATION: THE COMBINA-ION CONCEPT AND ITS EXPERIMENTAL ERIFICATION,
gricultural Research Service, Phoenix, Ariz. ater Conservation Lab.
. H. M. Van Bavel.
ater Resources Research, Vol 2, No 3, p 455-67, 1966. 13 p, 6 fig, 5 tab, 21 ref, append.

escriptors: *Evaporation, *Evapotranspiration, Model studies, *Arizona, Surface waters, ydrologic data, Soils, Alfalfa, Meteorology, athematical studies, Equations, Surface tension, ater vapor, Heat transfer, Radiation, Tempera-re, Topography, Vapor pressure, Latent heat, eather patterns, Forecasting, Testing, Evalua-n, Climatology, Winds, Wind velocity, Eleva-n.
entifiers: *Potential evaporation rate.

sing a combination of a surface energy balance uation and an approximate expression of water por and sensible heat transfer, an equation is for-ulated relating potential evaporation for net diation, ambient air properties, and surface ughness. The proposed model contains no empir-al constants or functions. Tests of the model in noenix, Arizona, using open water, wet bare soil, d well watered alfalfa, show excellent agreement calculated and measured values on an hourly d daily basis under a variety of circumstances. st conditions typically included advection of sen-le heat to the evaporating surface in a large pro-rtion to the latent heat flux, as well as high values radiant flux, ambient temperatures, and vapor essure deficits. The use of daily average values r the weather variables in the model, rather than urly data, did not give appreciably different sults or conclusions on a series of mostly clear ys, suggesting that the combination model is not ly accurate but also practical and generally ap-icable. (Woodard-USGS)
71-05587

ATCHMENT EVAPORATION AND POTEN-AL EVAPORATION-FURTHER DEVELOP-ENT OF A CLIMATOLOGIC RELATION-HIP,
epartment of Energy, Mines and Resources, Ot-wa (Ontario). Inland Waters Branch.
I. Morton.
urnal of Hydrology, Vol 12, No 2, p 81-99, nuary 1971. 19 p, 4 fig, 1 tab, 15 ref.

escriptors: *Evaporation, *Evapotranspiration, Mathematical models, Climatology, Climatic ta, Meteorological data, Model studies, Weather ta, Energy budget, Water balance, Solar radia-n, Snowpacks.
entifiers: *Canada, *Ireland, *Potential evapora-n.

hen evaporation from the surfaces of a region is nited by the availability of moisture, the resultant anges in the temperature and humidity of the erpassing air are reflected in the potential aporation. Such interactions have provided the sis for the development of a model in which the gional evaporation, a product of climatic, soil isture and vegetative processes, is estimated m its effects on potential evaporation or on presentative climatological observations. The sults are tested with previously published drologic and climatologic data from 20 river tchments in Canada and Ireland. These tchments have a range in annual runoff of ap-oximately zero to one meter and a range of snow ver duration from almost zero to six months. mparison of model predictions with precipita-n less runoff estimates for five-year periods pro-les reasonable evidence for the validity of the del with a maximum deviation of 44 mm per yr, 9%, and a standard error of estimate of 26 mm r yr. Seasonal comparisons show the variability catchment storage and the effects of climate and pography on regional evaporation. (Knapp-SGS)

W71-05588

AVAILABLE WATER AS RELATED TO EVAPOTRANSPIRATION RATES AND DEEP DRAINAGE,
Agricultural Research Service, Prosser, Wash.
For primary bibliographic entry see Field 02G.
W71-05606

NET AND SOLAR RADIATION RELATIONS OVER IRRIGATED FIELD CROPS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Leo J. Fritschen.
Agricultural Meteorology, Vol 4, p 55-62, 1967. 8 p, 1 tab, 12 ref.

Descriptors: *Evapotranspiration, *Solar radiation, *Soil moisture, *Irrigated land, *Field crops, Data collections, Statistical methods, Regression analysis, Equations, Albedo, Radiation, Alfalfa, Barley, Cotton, Oats, Wheat, Sorghum.
Identifiers: Standard errors.

A relation was sought between solar radiation and net radiation measured over irrigated field crops of alfalfa, barley, wheat, oats, cotton, and sorghum for estimating evapotranspiration from crop surfaces. Data collected under field conditions were analyzed by linear regression techniques. Standard deviation from regression was 0.02 ly/min for individual days and for individual crops. The regression equations changed from day to day; therefore, were of little value for estimation purposes. Seasonal data for individual crops were pooled and analyzed by linear regression. The resulting standard errors were about twice as large as those for individual days, ranging from 0.02 to 0.05 ly/min. When the data for all crops and all days were pooled and analyzed by linear regression, the resulting standard error was 0.06 ly/min. Thus, estimating net radiation for any of the crops from solar radiation would result in a standard error of 38 ly, or approximately 10%, for a 12-hour day having 649 ly incoming radiation. The regression equation may be solved using either hourly or daily solar radiation data. In the absence of net radiation data either the pooled regression or the individual crop regressions may provide sufficiently accurate estimates for some applications-for example, estimating evapotranspiration to be used in the design of irrigation projects. (Woodard-USGS)
W71-05622

WATER BALANCE IN LEAF TISSUE,
Ceskoslovenska Akademie Ved, Prague. Ustav Experimentalni Botaniky.
Jana Pospisilova.
Biologia Plantarum (Praha), Vol 11, No 2, p 119-129, 1969. 13 fig, 10 ref.

Descriptors: *Leaves, *Water balance, *Transpiration, *Absorption, *Water transfer, Plant physiology, Stomata, Laboratory tests, Humidity, Temperature, Gravimetry, Evaporation, Saturation, Time lag, Moisture stress, Plant tissues.
Identifiers: *Water potential, *Water saturation deficit.

The relative rates of water absorption and transpiration determine water balance in leaf tissue. A technique was developed for determining simultaneous water absorption and transpiration at various initial water saturation deficits (wsd) when these phenomena are occurring simultaneously in different parts of a leaf. A plexiglass chamber was built with 3 equal-sized compartments. A segment of leaf tissue could be separated by the compartments so that water could be absorbed on 1 side, transported through the middle compartment and transpirated on the other side. Leaves were subjected to 4 types of external conditions in which relative humidity and linear rate of airflow differed, creating varying water potential gradients between leaf and surrounding air. Water absorption, transpiration intensity and wsd were continuously monitored by gravimetric methods. Results indicated that high wsd are found in leaf tissue supplied with sufficient water from 1 side, even under conditions where evaporation and transpiration intensities were not extremely high. Comparing upper, middle and lower leaves and leaves from younger and older plants, it was found that upper leaves and leaves from younger plants showed the lowest water absorption/transpiration intensity ratios. Also, water transport was practically independent of vessel orientation in leaf tissue samples. Vessel incisisions resulted in considerable changes in water balance. (Casey-Arizona)
W71-05709

A STUDY OF THE MECHANISMS AND SUPPRESSION OF EVAPORATION OF WATER FROM SOILS,
Texas A and M Univ., College Station. Water Resources Inst.
C. W. Wendt.
Available from NTIS as PB-197 999, $3.00 in paper copy, $0.95 in microfiche. Texas Water Resources Institute, Texas A and M University, Technical Report 33, Feb 1971. 123 p, 25 tab, 38 fig, 13 ref. OWRR Project B-002-TEX (6).

Descriptors: *Evaporation, *Evaporation control, *Evapotranspiration, *Soil moisture, *Water conservation, Consumptive use, Irrigation.

Extensive greenhouse experiments were conducted to evaluate chemicals not previously studied extensively for their potential as evaporation suppressants. Included in the studies were crude oil, anionics, cationics, nonionics, silicones, polysaccharide-gum mixtures, oil-latex mixtures, fatty alcohols, and reflectance materials. Of these compounds, only crude oil and crude oil-cationic mixtures were effective in suppressing soil water evaporation significantly when applied to smooth Olton loam wet soil surfaces. This cationics apparently acted as a bond between the cation exchange capacity of the soil. In some cases the crude oil affected emergency of tomatoes and onions, but did not effect the emergence of cucumbers. The crude oil was most effective on smooth wet soil surfaces and least effective on rough dry surfaces. Crude oil-treated surfaces were effective against wind speeds up to 6.5 m/sec (15mph) for 3-4 days at rates as low as 946 l/ha (100 gal/acre). As soil temperature was increased from 10 deg C. to 38 deg C. crude oil-treated surfaces were less effective in suppressing evaporation due to the increased vapor pressure of the soil water. Varying the light intensity from 0.15 to 0.60 Langleys/min did not influence the evaporation from crude oil surfaces in the controlled environment chamber. Crude oil appears to be an effective evaporation suppressant when applied to a smooth wet soil surface. Further, it is most effective immediately after water applications when the soil water evaporation rate is the highest, and the most economical material reported to date ($3 - $18 per acre or $.06 a gallon).
W71-05717

2E. Streamflow and Runoff

A LABORATORY CATCHMENT AND ASSOCIATED INSTRUMENTATION,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02A.
W71-05353

A PROPOSED STREAMFLOW DATA PROGRAM FOR CENTRAL NEW ENGLAND,
Geological Survey, Boston, Mass.
Carl G. Johnson.
Geological Survey Open-file report, 1970. 38 p, 3 fig, 7 tab, 8 ref, append.

Descriptors: *Streamflow, *Hydrologic data, *Project planning, *New England, Evaluation, Data collections, Gaging stations, Time series analysis,

Water resources development, River basins, Watershed management, Flow characteristics, Channel morphology, Precipitation (Atmospheric), Topography, Regression analysis, Soils, Vegetation, Stream gages, Surface waters, Lakes, Elevation.
Identifiers: *Streamflow data evaluation (Central New England).

An evaluation of the streamflow data available in Central New England was made to provide guidelines for planning future programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives. A summary table includes all streamflow stations now in operation and those to be established for the proposed program. Each station is identified as to type of data and recommendations are made as to whether the station should be included in the proposed network or whether it has met its objective and could be discontinued. Data collected at most current-purpose gaging stations may also be used for planning and design. (Woodard-USGS)
W71-05360

STREAM DISCHARGE ESTIMATION,
Forest and Range Experiment Station, Rangiora (Newland).
For primary bibliographic entry see Field 07B.
W71-05361

A PROPOSED STREAMFLOW DATA PROGRAM FOR MISSOURI,
Geological Survey, Rolla, Mo.
For primary bibliographic entry see Field 07A.
W71-05369

AN OPTIMUM WATER ALLOCATION MODEL BASED ON AN ANALYSIS FOR THE KISSIMMEE RIVER BASIN (PHASE I)-PROGRESS REPORT.
Florida Univ., Gainesville. Dept. of Agricultural Economics; and Central and Southern Florida Flood Control District, West Palm Beach.

Florida University Water Resources Research Center Report, December 1970. 27 p, 3 fig, 11 tab. OWRR Project B-005-FLA (2).

Descriptors: *Water resources development, *Model studies, *Florida, *Surface waters, *Water allocation (Policy), Irrigation, Percolation, Agriculture, Mathematical studies, Equations, Computer programs, Hydrologic data, Hydrologic cycle, Lakes, Streams, Reservoirs, Storage, Evaporation, Water utilization, Consumptive use, Test procedures, Methodology, Evaluation, Water demand.
Identifiers: *Kissimmee River basin (Fla).

This research, concerning the optimum allocation of water in Central and Southern Florida, uses the Kissimmee River Basin as a pilot study area. A dynamic linear programming model was developed to allocate the water among the alternative uses within the upper sub-watershed and between time periods within that sub-watershed. The year was divided into four time periods for the purpose of data collection and developing the programming model. The determination of the time periods was based on the amount of precipitation and the demand for supplemental irrigation. The four time periods were: (1) June, July, August and September, (2) October and November, (3) December and January, and (4) February, March, April and May. Data were collected for each time period to estimate the benefits (such as, agricultural and recreational) from water, the quantity of water available for allocation (such as rainfall, runoff and evaporation), the restrictions on the use of water, and stage-storage-damage relationships. These data were then applied to the dynamic linear programming model to determine the optimum allocation of water under present conditions. The programming model proved useful for determining the optimum allocation of water among different time periods within the sub-watershed. (Woodard-USGS)
W71-05370

A PROPOSED STREAMFLOW-DATA PROGRAM FOR IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 07A.
W71-05373

SURFACE WATER DATA - QUEBEC, WATER YEAR 1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 07C.
W71-05375

FLOOD FREQUENCY IN ALASKA,
Geological Survey, Anchorage, Alaska.
Joseph M. Childers.
Geological Survey Alaska District Open-file report, 1970. 30 p, 3 fig, 3 tab, 5 ref, append.

Descriptors: *Floods, *Flood forecasting, *Alaska, *Hydrologic data, *Data collections, Streamflow, Gaging stations, Flow rates, Precipitation (Atmospheric), Geomorphology, Regional flood, Frequency, Flood plains, Hydrology, Maximum probable flood, Peak discharge, Runoff, Discharge measurement, Statistical methods.
Identifiers: Standard project flood, Intermediate regional flood.

Records of peak discharge at 183 sites were used to study flood frequency in Alaska. Peak stream discharges, where gaging-station records were available, were analyzed for 2, 5, 10, 25, and 50-year average-recurrence intervals. A regional analysis of the flood characteristics by multiple-regression methods gave a set of equations that can be used to estimate floods of selected recurrence intervals up to 50 years for any site on any stream in Alaska. The equations relate floods to drainage-basin characteristics. In Alaska the 50-year flood can be estimated from 10-year gaging station records with a standard error of 22 percent whereas the 50-year flood can be estimated from the regression equation with a standard error of 53 percent. Also, maximum known floods at more than 500 gaging stations and miscellaneous sites in Alaska were related to drainage-area size. An envelope curve of 500 cubic feet per second per square mile covered all but 2 floods in the State. (Woodard-USGS)
W71-05378

A PROPOSED STREAMFLOW DATA PROGRAM FOR MISSISSIPPI,
Geological Survey, Jackson, Miss.
James D. Shell, and Fred H. Thomson.
Geological Survey Open-file Report, 1970. 48 p, 5 fig, 10 tab.

Descriptors: *Streamflow, *Hydrologic data, *Project planning, *Mississippi, Data collections, Gaging stations, Evaluation, Time series analysis, River basins, Network design, Data processing, Regression analysis, Watershed management.
Identifiers: Current purpose data.

An evaluation is made of available streamflow data in Mississippi to provide guidelines for planning future hydrologic data collection programs. The evaluation is in three basic steps; definition of the long-term goals of the streamflow data program in quantitative form, examination and analysis of available data to determine goals achieved, and development of proposals of ways to meet the remaining goals. General objective of the data collection program is to be able to furnish necessary estimates of streamflow characteristics for any site on any stream in the State, with specific accurac goals. It was found that several of these goals coul be met by generalization of the data from gage basins by regression analysis. This allows significar changes to be made in the present collectio system that will permit emphasis to be placed on a taining unmet goals. A network design is presente for implementing the proposed streamflow dat program to meet future needs. (Lang-USGS)
W71-05445

SURFACE WATER SUPPLY OF THE UNITE STATES, 1961-65: PART 10. THE GREA BASIN.
Geological Survey, Washington, D.C.

For sale by the Superintendent of Documents, U Government Printing Office, Wash, DC 20402 Price $4.50 (paper cover). Geological Surve Water-Supply Paper 1927, 1970. 978 p, 1 fig, plate.

Descriptors: *Streamflow, *Hydrologic dat *Flow measurement, *Great Basin, *Gaging sta tions, Data collections, Flow rates, Average flov Surface waters, Low flow, Peak discharge, Strea gages, Reservoir stages, Lakes, Discharge measure ment.
Identifiers: *Streamflow basic data, Weste United States.

Records of stage, discharge, and content streams, lakes, and reservoirs in the Great Basin the western United States are presented for th period October 1, 1960 to September 30, 196 The tables of data include a description of the ga ing station, and daily, monthly, and yearl discharges of the stream. The description of the st tion gives the location, drainage area, record available, type and history of gage, averag discharge, extremes of discharge, and general re marks. For most gaging stations on lakes and rese voirs the data comprise a description of the statio and a monthly summary table of stage and con tents. Data for partial-record stations includ discharge measurements at low-flow partial-recor stations and annual maximum stage and discharg at crest-stage stations. (Woodard-USGS)
W71-05446

WATER RESOURCES - APPENDIX V O COLUMBIA-NORTH PACIFIC REGION COM PREHENSIVE FRAMEWORK STUDY,
Pacific Northwest River Basins Commission, Van couver, Wash.
For primary bibliographic entry see Field 02A.
W71-05449

BIG BLUE RIVER BASIN APPENDIX.
Nebraska Soil and Water Conservation Commis sion, Lincoln.

Nebraska Soil and Water Conservation Commis sion State Water Plan Publication No 201A, Sep tember 1968. 144 p, 3 fig, 35 tab, 6 ref, 7 plate.

Descriptors: *Water resources developmen *Groundwater, *Surface waters, *Nebraska, Irriga tion water, Recreation, Flood control, Erosion con trol, Reservoirs, Planning, Hydrogeology, Hydrolo gy, Geology, Hydrologic data, Water quality Water utilization.
Identifiers: *Big Blue River Basin (Nebraska).

This appendix presents information and data con cerning water resources development in the Bi Blue River Basin in Nebraska under six sections a follows: Flood Control; Water Quality; Irrigatio Water Management; Fish and Wildlife; Geolog and Groundwater; and Water Utilization. Flood have occurred in 35 of the 64 years of recor (1902-1965). Current efforts involve analysis o the flood problems. Suspended sediment is th most important pollutant in the Big Blue River Crop irrigation is a consumptive and a necessar use of water in Nebraska. The supply of outdoo

ation resources is critically short. Public areas nated for outdoor recreation include only percent of the total land area. Groundwater ge reservoirs are quite extensive in the upper central parts of the basin. The groundwater is currently declining in localized areas of concentration of irrigation wells. The water for municipal and industrial purposes is at nt being supplied entirely from groundwater es. Plans for water resources development ontrol are discussed. (See also W70-04603) odard-USGS)
05451

CT OF WATERSHED CHARAC-STICS ON THE TIME PARAMETERS OF OFF HYDROGRAPHS,
esota Univ., Minneapolis. Dept. of Agricul-Engineering.
rimary bibliographic entry see Field 02A.
05452

TION OF A BOUNDARY VALUE BLEM OF NONSTEADY SMOOTHLY YING FLOW OF A LIQUID BY THE IM-IT FINITE-DIFFERENCE METHOD,
rimary bibliographic entry see Field 08B.
05457

HWATER VERTEBRATE AND INVER-RATE ECOLOGY OF AMCHITKA ISLAND,
lle Memorial Inst., Columbus, Ohio.
M. Neubold, and William T. Helm.
able from NTIS as BMI 171 127, $3.00 in copy, $0.95 in microfiche. Annual Progress rt on the Amchitka Bioenvironmental Pro- April 1970. 48 p, 6 fig, 32 tab. AEC AT (26-1.
fiers: *Streams, *Ecology, *Fresh water gy, Streams, *Islands, Landforms, Ecology, tic animals, Biomass, *Amchitka Island.

ates are given for stream primary production, us and dissolved organic content (carbon nt), invertebrate populations, and fish popu-s. Salmon spawning on the Island is regarded nimal in terms of contributing to the comm-al salmon fishery. Most liberal estimates of salmon production on the Island amounted to 1,600 smolts. Similarly, the streams on the were estimated to produce approximately pink salmon fry to the marine environment. evidence existed for intertidal spawning by salmon, but no estimate could be hazarded Essentially, the data collected during the year borated the data collected during fiscal year that is, that the food-energy economics base lakes and streams under investigation are rily detritus based, judging from the food in-by the Dolly Varden and the threespine eback. Some variation, however, was ex-nced in the quality of food ingested by both olly Varden and threespine stickleback. This y varied with the season. During the summer ons of the year, some herbivorous insects were in significant quantities in the fishes' guts. included caddisflies and mayflies. In addi-the Dolly Varden did take threespine eback in the wintertime. The data collected, converted to biomass production, yielded ls that gave confidence that estimates of ener-w would be reliable.
05461

NORTH AFRICAN FLOOD DISASTER, EMBER 1969,
Locust Research Centre, London (England).
rimary bibliographic entry see Field 02B.
05484

ODS ON NAPA RIVER AT NAPA, FORNIA,
gical Survey, Washington, D.C.
rimary bibliographic entry see Field 07C.
05559

MOUNTAIN RUNOFF AND ITS RELATION TO PRECIPITATION, GROUNDWATER, AND RECHARGE TO THE CARBONATE AQUIFERS OF NITTANY VALLEY, PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02A.
W71-05560

EXTENDING THE RECORD ON THE TEME,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-05589

SEASONAL FLOOD BEHAVIOR IN A CLAY CATCHMENT,
Liverpool Univ. (England). Dept. of Geography.
A. M. Harvey.
Journal of Hydrology, Vol 12, No 2, p 129-144, January 1971. 16 p, 9 fig, 4 tab, 14 ref.

Descriptors: *Hydrograph analysis, *Unit hydrographs, *Floods, *Flood forecasting, *Rainfall-runoff relationships, Rainfall, Runoff forecasting, Infiltration, Soil moisture, Surface runoff, Duration curves, Depth-area-duration analysis, Clays, Permeability.
Identifiers: River Ter (England).

The unit hydrograph method is applied to the analysis of the flood hydrology of the River Ter, a stream draining a clay catchment in Eastern England. Two distinct types of simple flood hydrograph resulting from storm rainfall are identified, one characteristic of winter runoff, and a shorter duration type occurring only during the summer. Most of the major floods result from longer and more complex rain periods producing flood hydrographs which may be interpreted as coalescent or superimposed hydrographs of one of the two simple types. The seasonal variation in simple hydrograph form is interpreted as the result of runoff normally occurring from only part of the catchment during the summer months. This is probably due to areal variations in the nature of seasonal changes in soil moisture conditions and crop cover. (Knapp-USGS)
W71-05592

ESTIMATE OF GLACIERS SECULAR (1948-1966) VOLUMETRIC CHANGE AND ITS CONTRIBUTION TO THE DISCHARGE IN THE UPPER NORTH SASKATCHEWAN RIVER BASIN,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W71-05593

EVIDENCE FOR A DEEP WESTERN BOUNDARY CURRENT IN THE SOUTH INDIAN OCEAN,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02A.
W71-05596

A COMPARATIVE STUDY OF CRITICAL DROUGHT SIMULATION,
California Univ., Los Angeles. Dept. of Engineering Systems.
A. J. Askew, W. W-G.. Yeh, and W. A. Hall.
Water Resources Research, Vol 7, No 1, p 52-62, February 1971. 11 p, 1 fig, 5 tab, 6 ref. OWRR Project B-061-CAL (6).

Descriptors: *Simulation analysis, *Droughts, *Streamflow, *Statistical methods, *Synthesis, Computers, Time, Cost, Reservoir design, River flow, Monthly.
Identifiers: *Critical periods, *Generating techniques, *Historical periods.

A set of monthly streamflow records was generated and analyzed to give a set of synthetic critical periods. The three characteristics used to compare the historical periods and the generated periods in relation to long-term yearly mean streamflow were: (1) minimum permissible constant extraction per year; (2) deficiency in streamflow accumulated during the critical period; and (3) duration of the critical period in months. Their respective means and standard deviations were used in computing values for the mean of the values of the three characteristics. All steps included in the analytical and synthetic sections of the generating techniques studied were shown and 10 generating techniques were described in detail. Twenty-six rivers were used therefore for each of the three critical period characteristics and four active storage capacities computed, a set of 26 mean values was obtained for each of the 10 generating techniques utilized. A study of the results allowed a comparison between the generating techniques in regard to both their computer time cost and their ability to synthesize critical droughts comparable to those recorded historically. Results were influenced by relative aridity of the watershed and by reservoir size. (Kriss-Cornell)
W71-05683

2F. Groundwater

GEOCHEMICAL HYDROLOGY OF THE GROUNDWATER IN BATON ROUGE, LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-05348

SUMMARY OF GROUNDWATER HYDROLOGICAL DATA IN MICHIGAN FOR 1969,
Geological Survey, Lansing, Mich.
P. R. Giroux, and G. C. Huffman.
Geological Survey Data Report, 1970. 101 p, 43 fig, 2 tab, 92 ref.

Descriptors: *Hydrologic data, *Groundwater, *Water wells, *Michigan, Water levels, Data collections, Aquifers, Hydrographs, Water level fluctuations, Water table, Water supply, Withdrawal, Water treatment, Water utilization.
Identifiers: *Groundwater inventory (Michigan).

Records of groundwater levels in the principal aquifers of Michigan through 1969 are tabulated. Other related information including records of groundwater pumpage; data on municipal, public, and industrial water-supply facilities; and the effects of precipitation on groundwater levels are presented. Records of water levels in areas of heavy pumpage, and in areas where changes are principally from natural influences, are illustrated or tabulated to allow comparison between these types of water-level fluctuations. The water levels and related data provide a day-to-day record for the evaluation of available groundwater supplies. The long-term records serve as a framework to which short-term records may be related. During the first half of 1969, water levels in most wells continued the rising trend of the past several years. However, stages fell during the latter part of the year and were lower than at the end of 1968. During 1969, record-high levels were observed in 90 wells and record lows in 28. Most of the record lows occurred in heavily pumped areas, or at stations having only 2to 3 years of record. (Woodard-USGS)
W71-05351

UNSTEADY UNCONFINED FLOW TO GRAVITY WELLS,
Leeds Univ. (England). Dept. of Civil Engineering.
J. A. Fox, and I. Ali.
Institution of Civil Engineers (London) Proceedings, Vol 40, Paper No 7098, p 451-469, August 1968. 19 p, 16 fig, 2 tab, 4 ref.

Descriptors: *Groundwater movement, *Waves (Water), *Unsteady flow, *Mathematical models,

Drawdown, Hydraulic models, Mathematical studies, Seepage, Water levels.
Identifiers: Shallow-water wave theory.

Shallow-water wave theory can be used to describe unsteady flow through porous media. The significant point of difference between this application and more usual ones is the much greater friction losses experienced by a fluid when moving through such media. The solution involves the integration of a pair of quasilinear hyperbolic partial differential equations. A modification of the method of characteristics programmed for a digital computer was the technique chosen. Good agreement between theoretical and experimental values was obtained. Because the single-well problem is symmetrical, a 15 deg sector only was investigated. A tank was buil5 deg sector of a 12 ft dia circle. It was instrumented and provided with facilities for generating specific boundary conditions. Depth gages which fed their output to a recorder continuously measured depths along a radial line in the tank. The porous medium chosen consisted of 5/8-inch crushed stone. Results were inaccurate close to the well where the groundwater surface was strongly curved. (Knapp-USGS)
W71-05356

HYDROGEOLOGIC DATA FOR THE UPPER HOUSATONIC RIVER BASIN, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 07C.
W71-05357

GROUNDWATER RESOURCES IN THE EASTERN OSWEGO RIVER BASIN, NEW YORK,
Geological Survey, Albany, N.Y.
I. H. Kantrowitz.
New York Water Resources Commission Basin Planning Report ORB-2, 1970. 129 p, 44 fig, 6 plate, 11 tab, 25 ref.

Descriptors: *Water resources development, *New York, *Aquifers, Groundwater, Withdrawal, Water quality, Water wells, Water supply, Saline water, Water chemistry, Data collections, Hydrologic data, Hydrogeology, Glacial drift.
Identifiers: *Oswego River basin (NY).

The Eastern Oswego River basin includes approximately 2,500 square miles in central New York. About 35% of the 600,000 people in the basin rely on groundwater supplies. Groundwater sufficient for domestic supplies can generally be obtained. Sources of large supplies, such as for industries or municipalities, are present but not widespread. The principal aquifers in the basin are unconsolidated deposits of sorted and stratified sand and gravel. The most prolific sand and gravel aquifers are those that are hyy connected to streams or rivers. The total potential yield of 16 such aquifers is about 280 mgd. Currently, less than 5 mgd is being withdrawn. Two bedrock units, the limestone and middle shale units, are capable of yielding large quantities of water. Groundwater in much of the Eastern Oswego River basin is of poor quality. Large parts of the basin are underlain by relatively shallow salty groundwater. A total of about 21 mgd is withdrawn from all aquifers of the area for public, domestic, industrial, and commercial supplies. This is only 2% of the estimated natural groundwater recharge of 1,000 mgd. (Knapp-USGS)
W71-05374

GROUNDWATER IN PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
A. E. Becher.
Available from Bureau of Publications, Tenth and Market Streets, Harrisburg, Penn 17125. Pennsylvania Geologic Survey Educational Series No 3, 1970. 42 p, 29 fig, 1 map, 2 tab, 46 ref.

Descriptors: *Water resources, *Groundwater, *Pennsylvania, *Hydrogeology, Water resources development, Evaluation, Geology, Aquifers, Aquifer characteristics, Precipitation (Atmospheric), Surface waters, Streamflow, Runoff, Meteorology, Evapotranspiration, Water yield, Specific capacity, Water table, Hydrologic data, Water utilization, Consumptive use, Water pollution, Water pollution sources, Water quality, Water rights, Planning.

The existing knowledge of the groundwater resources of Pennsylvania is summarized. It was written to provide industrial and civil planners, developers, managers, and the public with sufficient information about statewide water resources to make intelligent, fundamental decisions about the future use, development, and protection of the groundwater. Pennsylvanians used about 6.6 BGD (billion gallons per day) of water in 1966, excluding electric power plant use. Although only 11% of the water was taken directly from groundwater sources, 25 to 35% of the people depend on groundwater for their personal needs. In addition, 55% of water companies obtain all their water, and another 13% obtain part of their water, from groundwater sources. Twenty-one of the 67 Pennsylvania counties obtain more than half their total water supplies from groundwater. Both regional and local problems of water quality exist in Pennsylvania. Many of these problems are the result of activities undertaken in the past without adequately protecting water resources. Waters that flow from coal mines and contain high concentrations of sulfuric acid and iron in solution are the major problem of water quality both in the volume of water involved and the total area affected. Second to acid mine waters in areal extent, but equally serious, is the pollution of Pennsylvania's stream and groundwaters by sewage and industrial wastes. Another type of groundwater pollution is caused by crude oil and saline waters moving upward into fresh water aquifers either through natural openings or through oil and gas wells abandoned prior to the well plugging law of 1951. (Woodard-USGS)
W71-05377

THE RELATION BETWEEN THE CHLORIDE WATERS OF THE WESTERN BELORUSSIAN UPLAND AND THE ZONES OF TECTONIC DEFORMATION, (IN RUSSIAN),
Akademiya Navuk BSSR, Minsk. Laboratoriya Geokhimicheskikh Problem.
G. V. Bogomolov, and O. N. Shpakov.
Doklady Akademii nauk BSSR, Vol 4, No 4, p 348-350, 1970. 1 tab, 8 ref.

Descriptors: *Groundwater, *Hydrostatic pressure, *Hydrogeology, Wells, Chlorine.
Identifiers: Belorussia.

Belorussian upland, the most ancient formation of the European plain of Russia, is under hydrostatic pressure of the Pripiyat, Baltic, and Moscow depressions. The composition of groundwater is closely related to the geologic history of these territories, their submergence under the sea water and subsequent formation of calcareous, quartzite-glauconitic, and chalk sediments. High chlorine content in fresh subterranean waters is attributed to the buried, metamorphized water of the former sea basins. The water samples with high content of chlorine were obtained predominantly from well points located near tectonic deformations and within the local drainage areas. (Wilde-Wisconsin)
W71-05405

WATER RESOURCES - APPENDIX V OF COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY,
Pacific Northwest River Basins Commission, Vancouver, Wash.
For primary bibliographic entry see Field 02A.
W71-05449

BIG BLUE RIVER BASIN APPENDIX.
Nebraska Soil and Water Conservation Commission, Lincoln.
For primary bibliographic entry see Field 02E.
W71-05451

PROCEDURE FOR COMPUTING ELASTIC SEEPAGE REGIME IN CONFI AQUIFERS,
For primary bibliographic entry see Field 08B.
W71-05455

GROUNDWATER RESERVOIR RESPONSE EARTH TIDES,
Virginia Polytechnic Inst., Blacksburg. Dep Geophysics.
Edwin S. Robinson.
In: Virginia Polytechnic Institute and State Un sity Water Resources Research Center Bulleti p 55-65, December 1970. 11 p, 2 tab, 8 ref. O Project A-023-VA (1).

Descriptors: *Water level fluctuations, *Gro water, *Water wells, Tidal effects, Vir Aquifers, Porosity, Storage coefficient, Perme ty, Confined water.
Identifiers: *Earth tides.

A study was undertaken in Virginia to exa tidal water level fluctuations in wells, and to d titatively relate observed tides and groundw reservoir storage parameters. Data from wells were examined, and tides were identifi twelve of these wells. The tides observed in wells can be related to the porosity and bulk m lus of an aquifer by means of the equa presented. To establish this relationship one have water level records, barometric records ocean tide records covering at least two week preferably 29 continuous days. (See also 05555) (Knapp-USGS)
W71-05556

MOUNTAIN RUNOFF AND ITS RELATION PRECIPITATION, GROUNDWATER, RECHARGE TO THE CARBONATE AQUI OF NITTANY VALLEY, PENNSYLVANIA,
Pennsylvania State Univ., University Park. De Geology and Geophysics.
For primary bibliographic entry see Field 02A.
W71-05560

A PROPOSED TECHNIQUE FOR IDENTIF TION OF UNCONFINED AQUIFER PARA TERS,
California Univ., Los Angeles.
William W-G. Yeh, and George W. Tauxe.
Journal of Hydrology, Vol 12, No 2, p 117 January 1971. 12 p, 2 fig, 2 tab, 8 ref.

Descriptors: *Linear programming, *Paran hydrology, *Groundwater movement, *Com programs, *Mathematical models, Systems a sis, Numerical analysis, Aquifers, Least sq method, Equations, Mathematical studies, steady flow.
Identifiers: Quasilinearization.

The technique of quasilinearization is appli the problem of identifying the parameters in a confined aquifer system. This new techniq shown to be a very effective way of converting observations based upon pumping tests int desired aquifer parameters. The procedu straightforward as it requires neither curve pl nor graphical matching. The parameters t identified are the hydraulic conductivity specific storage in an extensive unconfined aq system. Results and numerical experiments presented. (Knapp-USGS)
W71-05591

ESTIMATING INFILTRATION AND/OR PARAMETERS OF UNCONFINED AQUI FROM GROUNDWATER LEVEL OBSE TIONS,
C. Venetis.
Journal of Hydrology, Vol 12, No 2, p 161 January 1971. 9 p, 2 fig, 2 tab, 3 ref.

criptors: *Groundwater movement, *Infiltra-
, *Water level fluctuations, Hydraulic gradient,
neability, Transmissivity, Water balance,
age coefficient, Aquifers, Water table, Water
ls.
tifiers: Unconfined aquifers.

mechanism of the interplay between ground-
r recharge and depletion is examined and sim-
practical methods are developed for the estima-
of infiltration from groundwater level observa-
. Estimates of the aquifer parameters may also
btained when a long term water balance is
ible. The relationship between infiltration and
ndwater levels is analyzed through the linear
rential equation of the groundwater flow. The
retical results are simplified by approximation,
the parameters involved are lumped into three
tants which depend only on the relative posi-
of the point of observation. These can be
tly estimated from the recession of recorded
ndwater levels and a longterm water balance.
pp-USGS)
-05594

**ISTOCENE STRATIGRAPHY OF THE
ISBURY AREA, MARYLAND, AND ITS
ATIONSHIP TO THE LOWER EASTERN
RE: A SUBSURFACE APPROACH,**
yland Geological Survey, Baltimore.
Hansen, III.
yland Geological Survey Report of Investiga-
No 2, 1966. 56 p, 12 fig, 6 tab, 42 ref.

riptors: *Aquifers, *Maryland, *Stratigraphy,
astal plains, Hydrogeology, Sampling, Water
, Sedimentation, Quaternary period,
tocene epoch, Sea level.
tifiers: Salisbury (Md).

Salisbury, Maryland, water resources in-
gation afforded the opportunity for a detailed
rface study of the Pleistocene Series beneath
-square-mile area surrounding the city. Twen-
ur core holes and 15 test holes were drilled.
these new data emerged a clarification of the
graphic sequence. North of Salisbury a deep
tocene paleochannel was discovered. Filling in
overlying this paleochannel is the 'red gravelly'
s of the Salisbury Formation, a fluvial sand
sited by an aggrading river during a period of
base-level conditions, possibly coincident
the Sangamon Interglaciation. The estuarine
valent of the 'red gravelly' facies is the Beaver-
facies, a gray-white, fine to coarse-grained
. The 'red gravelly' facies is thickest north and
of Salisbury; it wedges out easterly toward
nsburg and southerly toward Princess Anne.
plementing this is an easterly and southerly
ening of the Beaverdam facies. Overlying the
bury Formation is the Walston Formation, an
sively developed fine-grained sediment. The
nsburg Sand, a coastal dune deposit, overlies
Walston Formation in the divide area. The
graphic relationship between the Parsonsburg
and the Walston Formation reflects the trans-
ive advance of dune sand over a surrounding
marsh facies. By the end of late Wisconsin
the present-day drainage network was incised
the terrane. As sea level rose during the sub-
ent Holocene marine transgression, interca-
fluvial gravels and marsh muds were
sited in and adjacent to present-day rivers. (K-
-USGS)
-05619

**SPHATE MOVEMENT IN SURFACE RUN-
WATER,**
stry of Works, Nelson (New Zealand). Mou-
Soil Conservation Station.
rimary bibliographic entry see Field 05B.
-05625

**PING TEST PROCEDURES FOR AQUIFER
LYSIS,**
igan Dept. of Public Health, Lansing. Section
ater Supply.
les J. Linck.
Typescript, 1970. 8 p.

Descriptors: *Pumping testing, *Performance, *Groundwater, Thiems equation, Theis equations, Transmissability, Water wells, Observation wells.
Identifiers: *Jacob method, *Pizometer, Orifice meters.

Obtaining reliable data which are amendable to mathematical analysis is one of the purposes of a pumping test. Such data are usually obtained by pumping one well continuously, and at constant rate, while making periodic measurements on water level changes in nearby observation wells. A relatively simple task at first glance, but no one can be sure the data can be analyzed with available techniques. Present equilibrium and non-equilibrium methods of analysis make the classic four basic assumptions. These assumptions, however, are not factors which the field man can adjust for in setting up his test. The analyst while also not being able to adjust for them can attribute departures of the data to departures of the aquifer from the ideal. Other classic assumptions are discussed which can be met by proper field design. (Campbell-NWWA)
W71-05694

APPLICATION OF ELECTRICAL AND RADIOACTIVE WELL LOGGING TO GROUNDWATER HYDROLOGY,
Geological Survey, Washington, D.C.; and Pennsylvania State Geological Survey, Harrisburg.
For primary bibliographic entry see Field 04B.
W71-05697

GROUNDWATER HYDROLOGY FOR WATER WELL DRILLING CONTRACTORS,
Kent State Univ., Ohio. Dept. of Geology.
J. L. Rau.
National Water Well Association, Columbus, Ohio, 1970. 259 p.

Descriptors: *Hydrogeology, *Geomorphology, Geologic mapping, Aquifers, Aquicludes, Geologic formations, Aquifer characteristics, Artesian aquifers, Recharge, Logging (Recording), Water chemistry, Appalachian Mountain region, Atlantic Coastal Plain, Florida, Southeast U.S., Mineralogy, Igneous rocks, Sedimentary rocks, Metamorphic rocks, Hydrologic cycle, Springs.
Identifiers: *Topographic maps, *Geologic column, Rock unit correlation, Geologic cross-section construction, Record keeping, Aquifer test methods, Groundwater contamination.

The objective of this book is to present the basic geologic factors which control the occurrence, availability, and quality of groundwater. In an introductory treatment of this material the author believes it is more important to consider the principles of geology as they relate to the discovery and exploitation of groundwater rather than to develop the quantitative aspects of groundwater hydrology. Groundwater occurs in a geologica framework and unless the nature of the framework is understood an analysis of equations or computing procedures for developing various types of aquifers is of little use. Furthemore, this text is designed primarily for the water well drilling contractor who has had no formal training in geology, but it is also applicable to the general public. The author's treatment of groundwater hydrology and geology emphasizes the Eastern United States. (Campbell-NWWA)
W71-05699

2G. Water in Soils

THE PREDICTION OF UNSATURATED FLOW RATES FROM PHYSICAL PROPERTIES OF THE POROUS MEDIUM,
Oregon State Univ., Corvallis. Dept. of Soils.
Larry L. Boersma.
Available from NTIS as PB-197 880, $3.00 in paper copy, $0.95 in microfiche. Oregon State University Water Resources Research Institute Project Completion Report, December 31, 1970. 15 p, 7 fig, 7 ref. OWRR Project B-001-ORE (8).

Descriptors: *Soil water movement, *Unsaturated flow, *Permeability, *Porous media, Forecasting, Model studies, Equations, Porosity, Pervious soils, Soil properties, Pore pressure, Methodology, Gamma rays, Test procedures.
Identifiers: Mercury intrusion porosimeter, Pore size, Soil water characteristic curve.

The only methods which make it possible to obtain water transmission coefficients of porous media without the use of complicated experimental techniques are prediction methods based on physical properties of the medium. Simple laboratory techniques were developed to measure the physical properties needed in these prediction methods and to check these methods through a series of systematic measurements. Pore size distributions were determined by the mercury intrusion method. The mercury intrusion porosimeter is an instrument by which pressure can be applied to a reservoir of mercury in contact with a porous solid sample. Precise measurement of changes in the volume of mercury as the pressure is increased provides a measure of the volume of pores in a given size range. The permeabilities of the materials were measured with a constant head permeameter. Bulk densities and porosities were obtained with gamma ray attenuation equipment. A total of 63 samples was tested with permeabilities ranging from 1.5-39.1 square microns. The permeability of the inert porous materials considered can be predicted reliably when the pore size distribution is known. Mercury intrusion is an efficient and highly reproducible method to obtain the pore size distribution of soils. Mercury intrusion data can be used to provide the quantitative information required in transport models for water, heat and chemicals in porous media. (Woodard-USGS)
W71-05335

MOISTURE CHARACTERISTICS OF PENNSYLVANIA SOILS: III. PARENT MATERIAL AND DRAINAGE RELATIONSHIPS,
Pennsylvania State Univ., University Park. Dept. of Soil Genesis and Morphology.
G. W. Petersen, R. L. Cunningham, and R. P. Matelski.
Soil Science Society of America Proceedings, Vol 35, No 1, p 115-119, January-February 1971. 5 p, 5 fig, 3 tab, 17 ref.

Descriptors: *Soil moisture, *Soil-water-plant relationships, *Moisture content, Soil texture, Provenance, Soil types, Soil horizons, Soil physical properties, Porosity, Permeability, Soil formation.
Identifiers: Available moisture (Soil).

Available moisture (Wa), assumed to be the difference between moisture contents of 'undisturbed cores' equilibrated at 1/3 atm of tension and of sieved samples equilibrated at 15 atm of tension, was determined on samples collected from 207 profiles in 27 Pennsylvania counties. Weighted means of Wa, coarse fragments, sand, silt, and clay were calculated from A, B, and C horizons and for 0-30, 30-60, 60-90, and 90-120-cm depth increments for each soil profile, grouped according to parent material and drainage class. Parent material groups showed the following decreasing relative amounts of cumulative Wa: aeolian, alluvium, limestone, till, shale, sandstone, glacial-fluvial. Differences in Wa are related to textural relationships and course fragment contents, with Wa decreasing with increasing amounts of clay, sand, and coarse fragments. Wa generally decreased with increasing depth within each parent material group. Differences in the drainage were usually related to the parent material from which the soil developed. Therefore, differences in parent material should be the primary consideration when estimating Wa, and the effect of drainage conditions upon Wa should only be considered when these differences occur within a parent material group. (Knapp-USGS)
W71-05343

A CAPILLARY PERTURBATION STUDY OF TWO-PHASE FLOW INFILTRATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Alain G. Noblanc.
M. Sc. Thesis, November 1970. 64 p, 21 fig, 3 ref. OWRR Project B-033-Colo (3).

Descriptors: *Infiltration, *Unsaturated flow, *Soil water movement, *Model studies, *Capillary action, Water, Air, Darcy's law, Equations, Soil water, Porosity, Porous media, Saturation, Permeability, Flow characteristics, Mathematical models, Numerical analysis.
Identifiers: Buckley-Leverett equations.

This study presents an analytical treatment of unidimensional flow of two immiscible fluids, water and air, into a porous medium. From the principle of continuity and Darcy's law applied to both fluids, a second order partial differential equation is derived in terms of water saturation, time and depth into the medium. In this differential equation the effect of capillarity is represented by a perturbation term. Even though the equation is solved approximately, the effect of capillarity is not neglected. The knowledge of an approximate saturation profile leads to the determination of the rate of water infiltration by a new combination of Darcy's law and principle of continuity. A numerical solution was found for a fine sand, semi-infinite porous medium with several different boundary and initial conditions. Infiltration curves and saturation profiles are presented. (Woodard-USGS)
W71-05444

SORPTION AND DESORPTION OF CHLORINATED HYDROCARBON PESTICIDES BY CLAY MINERALS,
Missouri Univ., Rolla. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-05447

ON THE PROBLEM OF DERIVING A SYSTEM OF EQUATIONS DESCRIBING THE MOTION OF WATER-SATURATED COHESIONLESS SOIL CONSIDERED AS A MULTIPHASE MEDIUM,
For primary bibliographic entry see Field 08D.
W71-05458

STONE PAVEMENTS IN DESERTS,
University Coll., London (England). Dept. of Geography.
Ronald U. Cooke.
Annals, Association of American Geographers, Vol 60, No 3, p 560-577, September 1970. 14 fig, 76 ref.

Descriptors: *Geomorphology, *Deserts, *Weathering, *Wind pressure, *Environmental effects, Running water, Runoff, California, Particle size, Particle shape, Rocks, Landforms, Solubility, Mode of action, On-site investigations, Soil profiles, Alluvium, Soil horizons, Silts, Clays, Fine aggregates, Fine-textured soils, Soil types, Seepage, Sediments, Sediment distribution, Sedimentary structures, Raindrops, Salts, Vegetation effects, Creep, Desiccation, Frost action, Chemical degradation, Sands, Deposition, Gravels.
Identifiers: *Stone pavements, *Atacama Desert, *Deflation, *Mojave Desert.

Stone pavements are defined as armored surfaces comprising intricate mosaics of coarse particles, usually only 1 or 2 stones thick, that are set in deposits of sand, silt or clay. They occur widely, but most often in hot, little-vegetated deserts. Their formation has long been thought due to deflation, which is wind surface action causing the removal of lighter particles, leaving the heavier pebbles behind, which protect the underlying fine materials. It is argued that, in geomorphology, diverse processes working in differing areas from differing initial conditions often produce similar final forms, and that single process explanations are usually naive. Pavement studies were therefore carried out in several deserts, concentrating mostly on the Mojave and Atacama. The resulting data were then used to construct likely alternative modes of pavement formation: (1) wash and creep processes (2) upward particular migration (through freezing and thawing cycles, saturation and desiccation cycles and alternate salt solution and recrystallization) (3) insolation weathering (4) frost weathering (5) salt weathering (6) chemical processes and (7) superficial disintegration processes. Each process is described. It is felt that deflation may be relatively unimportant and that running water and upward imgration processes abetted by superficial disintegration are probably quite important. It seems certain that pavement areas differ greatly in their ages, history and formation processes. (Casey-Arizona)
W71-05473

PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL: TEMPERATURE AND BULK DENSITY EFFECTS,
Washington State Univ., Pullman. Dept. of Soil Science.
G. S. Campbell, and Walter H. Gardner.
Soil Science Society of America Proceedings, Vol 35, No 1, p 8-12, January-February 1971. 5 p, 4 fig, 1 tab, 17 ref. USAEC Project AT (45-1)-1543, Project W-68.

Descriptors: *Chemical potential, *Bulk density, *Temperature, *Vapor pressure, Soil texture, Soil physical properties, Soil water movement, Humidity, Water temperature.
Identifiers: Water potential, Psychrometers, Matric potential.

Changes in soil water potential with temperature were determined using thermocouple psychrometers on samples of four soils. Change in soil water potential with temperature becomes greater as soils become drier. The finer textured soils showed a greater change in water potential with temperature than did coarser soils at similar water potentials. Water potential change with bulk density also was determined for samples of three soils. Little change was noted except on a clay subsoil sample. In most cases negligible differences will arise from measuring water potential at laboratory temperature rather than at the temperature existing in the field and from use of disturbed field samples with altered bulk density rather than undisturbed field soil. However, at water potentials below about -20 bars, temperature effects may become significant, especially in fine textured soils, and measurements on clay subsoils may be significantly affected by changes in bulk density. (Knapp-USGS)
W71-05604

STABILITY OF MONTMORILLONITES: 1. BELLE FOURCHE AND CLAY SPUR MONTMORILLONITES,
Washington State Univ., Pullman. Dept. of Soil Science.
J. A. Kittrick.
Soil Science Society of America Proceedings, Vol 35, No 1, p 140-145, January-February 1971. 6 p, 1 fig, 2 tab, 22 ref. FWQA Program 16060 DGK.

Descriptors: *Weathering, *Equilibrium, *Clay minerals, *Montmorillonite, *Kaolinite, Leaching, Chemical reactions, Thermodynamics, Solubility, Free energy.
Identifiers: *Clay mineral equilibria.

Montmorillonite has the variable chemical composition and the exchangeable ions that are typical features of the more complicated minerals that form in the weathering environment. Stability determinations are presented for montmorillonites from Belle Fourche, South Dakota and Clay Spur, Wyoming. A montmorillonite-kaolinite mixture established the montmorillonite-kaolinite join and demonstrated montmorillonite-kaolinite equilibria. The solution composition of several other samples helped define an experimental Belle Fourche-Clay Spur montmorillonite solubility line. A free en
change of -2468.5 plus or minus 0.3 kcal per m
was calculated for Belle Fourche and Clay S
montmorillonites, based upon the assumption
Fe ion in solution was controlled by hematite.
napp-USGS)
W71-05605

AVAILABLE WATER AS RELATED EVAPOTRANSPIRATION RATES AND DI DRAINAGE,
Agricultural Research Service, Prosser, Wash.
D. E. Miller, and J. S. Aarstad.
Soil Science Society of America Proceedings, 35, No 1, p 131-134, January-February 1971. 4 fig, 4 tab, 8 ref.

Descriptors: *Field capacity, *Evapotranspirat
*Irrigation efficiency, *Drainage, Soil water m
ment, Water management (Applied), Percolat
Moisture content, Laboratory tests.
Identifiers: Deep drainage (Soil water).

Soil water movement following irrigation was e
uated for different rates of evapotranspiration
depths of irrigation in laboratory syste
Downward flow of soil water decreased
evapotranspiration rate increased. Under u
summer environmental conditions, evapotransp
tion reduced deep drainage sufficiently to a
reasonable estimates of actual available water t
made from conventional field capacity data. Be
estimates were obtained by adjusting sampling t
according to expected evapotranspiration rates
the soil depth to be involved. The data show
large errors are probable in field measurement
evapotranspiration rates if deep drainage
ignored. (Knapp-USGS)
W71-05606

LOW-TEMPERATURE PHASES OF INTER CIAL WATER IN CLAY-WATER SYSTEMS,
Cold Regions Research and Engineering L
Hanover, N.H.
Duwayne M. Anderson, and Allen R. Tice.
Soil Science Society of America Proceedings, 35, No 1, p 47-54, January-February 1971. 8 p fig, 2 tab, 19 ref.

Descriptors: *Clay minerals, *Soil moisture, *
ferential thermal analysis, *Freezing, Frost,
tions exchange, Mineralogy, Thawing, W
chemistry, Soil water, Ice, Heat transfer.
Identifiers: Interfacial water (Clays).

Low temperature differential thermal analyse
selected clay-water systems were made to lo
important phase change temperatures and to de
fruitful temperature-pressure fields for pre
calorimetric investigation. In addition to an
otherm corresponding to initial freezing, one,
or three exotherms were observed between -
and-60C. The low temperature exotherms do
depend critically upon water content, but cle
they are related to clay mineral and exchange
cation type. The evolution of heat in this temp
ture range probably corresponds to a phase cha
in the interfacial water. (Knapp-USGS)
W71-05607

MEASURING SOIL MATRIC POTENTIAL SITU BY SENSING HEAT DISSIPAT WITHIN A POROUS BODY: 1. THEORY A SENSOR CONSTRUCTION,
Agricultural Research Service, Riverside, C
Salinity Lab.
C. J. Phene, G. J. Hoffman, and S. L. Rawlins.
Soil Science Society of America Proceedings, 35, No 1, p 27-33, January-February 1971. 7 fig, 1 tab, 11 ref.

Descriptors: *Soil water movement, *Heat f
*Chemical potential, *Instrumentation, Po
media, Mathematical models, Moisture me
Soil moisture meters, Calibrations, Moisture
tent, Bouyoucos blocks.
Identifiers: *Matric potential sensor.

matric potential sensor measures heat dissipation sense the water content of a porous block in uilibrium with soil. It consists of a P-N junction ode that is surrounded by a heating coil and embedded in a porous medium. A theoretical model scribes the sensor in terms of its limiting parameers. Geometry, size, rate of heat input, and duran of heating are chosen to obtain a desired gree of accuracy and to make the measurements lependent of the surrounding soil. Construction, ibration, measurement, and temperature corction techniques are described. Since the electri- output of the sensor is linear with temperature, ingle calibration curve is adequate at all temratures within the accuracy reported. By varying composition of the porous body, the range and sitivity of the sensor can be altered. (Knapp-GS)
71-05608

UX-GRADIENT RELATIONSHIPS FOR TURATED FLOW OF WATER THROUGH XTURES OF SAND, SILT, AND CLAY,
rdue Univ., Lafayette, Ind. Dept. of Agronomy.
A. Russell, and D. Swartzendruber.
l Science Society of America Proceedings, Vol No 1, p 21-26, January-February 1971. 6 p, 9 16 ref.

scriptors: *Soil water movement, *Permeability, ydraulic gradient, *Clays, Hydraulic conductivi- Darcy's law, Porous media, Flowmeters, Expane clays, Expansive soils, Groundwater movent.
ntifiers: Non-Darcian flow.

ter flux was studied as a function of hydraulic dient for water-saturated mixtures of sand, silt, linite, illite, and bentonite. Flow rates were asured in sensitive capillary-tube flowmeters taining differential manometers, such manome- also being used to measure gradients across the meameters. Measurements were relatively rapid were obtained for a series of increasing dients followed immediately by repetition of alnate points in the direction of decreasing dients. The method eliminated errors arising m time changes in hydraulic conductivity, poration loss at the flow outlet, and bubble vement in small-bore capillary tubes. Nonelling mixtures (sand, silt, kaolinite, and illite) erally exhibited good Darcian proportionality ween flux and gradient, except for two lessn-proportional responses, one of which could be ounted for by fine-particle migration. Swelling tures (sand, silt, and bentonite) yielded nonprotional flux-gradient curves of a generally sigdal shape. (Knapp-USGS)
1-05609

LCULATION OF HYDRAULIC CONDUCITY: A FURTHER EVALUATION OF SOME EDICTIVE METHODS,
vaii Univ., Honolulu. Dept. of Soil Science; and Pont de Nemours (E.I.) and Co., Aiken S.C. annah River Lab.
E. Green, and J. C. Corey.
Science Society of America Proceedings, Vol No 1, p 3-8, January-February 1971. 6 p, 8 fig, b, 16 ref.

criptors: *Hydraulic conductivity, *Soil water vement, Model studies, Laboratory tests, Unrated flow, Infiltration, Computer programs, hematical models, Moisture content.
ntifiers: Hydraulic conductivity calculation.

computational method based on the pore-inction model of Marshall was shown to compare orably with modified methods of Millington and rk and of Marshall for prediction of hydraulic ductivity vs. water content on a number of soils a glass bead system. All methods required ching one point on the calculated hydraulic ductivity curve to an experimentally measured raulic conductivity value. The calculation hods adequately predicted the experimentally sured values and provide satisfactory conductivity data for many applications. An advantage of the proposed method is its independence of the value chosen for the exponent on the porosity term in the prediction equation. (Knapp-USGS)
W71-05610

MOISTURE RETENTION OF CULTIVATED AND PASTURED MOLLISOLS AND ALFISOLS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
C. B. England.
Soil Science Society of America Proceedings, Vol 35, No 1, p 147-149, January-February 1971. 3 p, 3 fig, 1 tab.

Descriptors: *Soil structure, *Moisture content, *Soil-water-plant relationships, *Cultivation, Mathematical models, Land use, Data collections.
Identifiers: *Moisture retention.

Comparison of surface soil mositure characteristic curves for Mollisols and Alfisols under pasture and row-crop cultivation revealed that below 1/3 bar suctions cultivated Mollisols retained 40% more water and cultivated Alfisols retained 25% more than corresponding pastured soils. At tensions above 1/3 bar, cultivated soils of both orders held less water. (Knapp-USGS)
W71-05611

EFFECT OF TRICKLE IRRIGATION INTERVALS ON DISTRIBUTION AND UTILIZATION OF SOIL MOISTURE IN A VINEYARD,
Hebrew Univ., Jerusalem (Israel). Dept. of Irrigation; and Ministry of Agriculture, Rehovoth (Israel).
S. D. Goldbert, M. Rinot, and N. Karu.
Soil Science Society of America Proceedings, Vol 35, No 1, p 127-130, January-February 1971. 4 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Irrigation effects, *Soil chemical properties, *Soil water movement, *Crop response, *Leaching, Moisture content, Water utilization, Consumptive use, Irrigation design, Soil-water-plant relationships.
Identifiers: *Trickle irrigation.

In an established vineyard on sandy clay soil the effect of trickle irrigation interval on soil moisture and salt distribution and relative water use efficiency was examined. The distribution of soil moisture and salinity resulting from this irrigation method is two dimensional, with moisture contents high along and beneath the row and decreasing laterally. The main active soil layer supplying water to the roots was found to be restricted to a strip approximately 2 m wide and 120 cm deep beneath the rows, whereas the total distance between rows was 3 m. The effect of shorter irrigation intervals, with proportionally smaller amounts of water applied in a single irrigation, was to decrease the variations of moisture content in the root zone and establish a continuously higher moisture regime. Salts were concentrated in a surface pocket and a deep layer with a leached zone between them. The relative position of the concentration layers was determined by the amount of water applied in a single irrigation. Relative water use efficiency was positively affected by shorter irrigation intervals both in terms of grape production and weight of prunings. (Knapp-USGS)
W71-05612

NUMERICAL ANALYSIS OF SOIL-MOISTURE SYSTEMS,
Drexel Univ., Philadelphia, Pa. Dept. of Civil Engineering and Mechanics.
Irwin Remson, A. Alexander Fungaroli, and George M. Hornberger.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 93, No IR3, p 153-166, September 1967. 14 p, 9 fig, 2 tab, 12 ref, append.
NSF Grant GK-635.

Descriptors: *Soil moisture, *Unsaturated flow, *Numerical analysis, *Mathematical models, Evaporation, Hysteresis, Infiltration, Hydrogeology, Soil water movement.
Identifiers: Soil moisture analysis.

Soil-moisture systems are analyzed using a numerical technique and a digital computer. The technique is applicable to unsteady-flow systems in nonhomogeneous soils. Variable initial and boundary conditions may be considered. Nonlinear multivalued relationships between matrix moisture content, capillary potential, and hydraulic conductivity may be incorporated. The method is applicable in theory to one-, two-, or three-dimensional systems. A one-dimensional unsteady-flow system was analyzed and used to study the effects of evaporation and soil-moisture hysteresis on a draining mass of infiltrated rainfall. (Knapp-USGS)
W71-05621

PHOSPHATE MOVEMENT IN SURFACE RUNOFF WATER,
Ministry of Works, Nelson (New Zealand). Moutere Soil Conservation Station.
For primary bibliographic entry see Field 05B.
W71-05625

RHEOLOGICAL PROPERTIES AND BEARING CAPACITY OF FROZEN SOILS,
For primary bibliographic entry see Field 02C.
W71-05671

TILLAGE SYSTEM EFFECTS ON WATER USE EFFICIENCY,
Virginia Polytechnic Inst., Blacksburg. Dept. of Agricultural Engineering.
V. O. Shanholtz, and J. H. Lillard.
Journal of Soil and Water Conservation, Vol 24, No 5, p 186-189, Sept-Oct 1969. 5 fig, 4 tab, 6 ref.
OWRR Project A-018-VA (4).

Descriptors: *Water utilization efficiency, *Soil-water-plant relationships, *Evaporation control, Water conservation, ZEA Mays, Soil water, Soil temperature, Surface runoff, Plant growth.
Identifiers: *No tillage, *Conventional tillage, Corn plant growth.

A hydraulic performance of two radically different row crop tillage systems, conventional tillage and no tillage was studied in 1966, 1967, and 1968. A randomized complete block statistical design was used to evaluate differences in the two systems. The greatest difference in total available soil water always occurred at planting date and progressively decreased during the growing season. No significant differences at the 5% level could be detected below 24 inches. Superior growth and yields were observed on the no tillage system, which resulted in more efficient utilization of available water. The advantages are attributed to the significantly less surface runoff, evaporation, and to the generally more favorable physical root zone environment for superior plant development which this system provides.
W71-05720

2H. Lakes

GLACIAL GEOLOGY OF THE CHAMPLAIN VALLEY: 1966-1970,
Vermont Univ., Burlington. Dept. of Geology.
For primary bibliographic entry see Field 02C.
W71-05337

A PRELIMINARY STUDY OF THE RELATIONSHIPS BETWEEN STREAM WATER QUALITY AND WATERSHED CHARACTERISTICS FOR THE TRUCKEE RIVER,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 05A.
W71-05338

A CONSIDERATION OF POLLEN, DIATOMS AND OTHER REMAINS IN POSTGLACIAL SEDIMENTS,
Iowa State Univ., Dept. of Botany and Plant Pathology; and Iowa Lakeside Lab., Milford.
For primary bibliographic entry see Field 02J.
W71-05340

BAIKAL ARTESIAN WATERSHED, (IN RUSSIAN),
Nauchno-Issledovatelskaya Laboratoriya Geologii Zarubezhnykh Stran, Moscow (USSR).
N. A. Marinov.
Doklady Akademii nauk SSSR, Vol 191, No 4, p 897-900. 1 fig, 4 ref.

Descriptors: *Lakes, *Geomorphology, *Watersheds (Basins), Geothermal studies, Temperature, Hydrostatic pressure, Water properties.
Identifiers: *Lake Baikal (USSR).

A detailed description is given of the very complex geological features of the Baikal watershed formed by recent tectonic deformations that imparted to Lake Baikal its maximum depth of 1620 m over a 5 km deep crystalline foundation. The outstanding peculiarity of this geomorphological area is the presence of a 2500 m deep sheet of fresh subterranean water. The depressions of the watershed exhibit an augmented geothermal regime with water as the depth of about 2000 m attaining temperature from 75 to 90C. The deep layers of water are enriched in hydrogen, methane, heavy hydrocarbons, hydrogen sulfied, and carbon dioxide. The high hydrostatic pressure converts the Baikal depression into the world's largest artesian well of high water exchange dynamics. The youthful age of Baikal waters is disclosed by the presense of tritium in the deepest horizons of the lake. (Wild-Wisconsin)
W71-05394

EXPERIMENTAL INVESTIGATION OF THE PRODUCTION OF BACTERIA IN WATER AND CONSUMPTION OF BACTERIA BY DAPHNIA, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennikh Vod.
For primary bibliographic entry see Field 05F.
W71-05397

POLLUTION, OCEANOLOGY AND LIMNOLOGY IN THE GREAT LAKES,
Northeastern Illinois State Coll., Chicago. Dept. of Geography.
Roger H. Charlier.
Marine Technology Society Journal, Vol 4, No 3, p 59-68, 1970. 2 fig, 3 tab, 47 ref.

Descriptors: *Water pollution, *Limnology, *Oceanography, *Great Lakes, Meteorology, Evaporation, Precipitation (Atmospheric), Interfaces, Winds, Climates, Atmosphere, Inflow, Groundwater, Soil moisture, Energy budget, Heat, Currents (Water), Seiches, Diffusion, Waves (Water), Shores, Water levels, St Lawrence Seaway, Algae, Eutrophication, Fish, Bacteria, Organic wastes, Oil wastes, Viruses, Thermal pollution, Radioactive wastes, Potamology, Salinity, Temperature, Geology, Illinois, Wisconsin, Michigan, Indiana, Pennsylvania, Ohio, New York, Minnesota, Costs.
Identifiers: Outflow, Bottom processes.

The Great Lakes provide a challenging area for research in limnology, potamology, oceanology, and fisheries biology. Fifteen agencies of the federal government in the departments of Interior, Agriculture, Defense, and Commerce are involved in research, surveys, and studies. At the international level, the International Joint Commission, the Great Lakes Study Group, and the Great Lakes Fishery Commission deal directly with problems; at least 17 private corporations are directly connected with Great Lakes research, use, and marketing. By 1967, research programs were conducted by Canadian federal government agencies, by Ontario government and its agencies, and by universities and research foundations. In the United States, universities, state agencies, and the federal government and one private industry carried on investigations. Programs were proposed on lake meteorology, terrestrial water budget, energy balance and water movement. Major benefits are expected from the use of Lake Ontario as a model ocean in the study of air-water interface problems, water level variations, climate modification by large water bodies, ice formation and dissipation, water movements, evaporation measurement techniques and the physical factors influencing eutrophication, pollution, and sedimentation. (Jones-Wisconsin)
W71-05398

LAKES: THE VALUE OF RECENT RESEARCH TO MEASURE EUTROPHICATION AND TO INDICATE POSSIBLE CAUSES,
Marine Dept., Rotorua (New Zealand). Fisheries Research Division.
For primary bibliographic entry see Field 05B.
W71-05401

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainesville.
W. C. Huber, and Armando I. Perez.
Florida Water Resources Center Completion Report, October 29, 1967. 128 p, 11 fig, 2 tab, 25 ref, 2 append. OWRR Project A-014-FLA (1).

Descriptors: *Energy budget, *Solar radiation, *Lakes, *Reservoirs, Surface waters, Hydrologic cycle, Thermal pollution, Thermal stratification, Water temperature, Evaporation.
Identifiers: Atmospheric radiation.

Evaluation of terms in the energy budget is an integral part of the prediction of thermal changes in natural water bodies. Lakes, reservoirs, streams, and tidal waters receive heat from shortwave solar radiation, longwave atmospheric radiation, and advectively from surface water inflows. The net advective heat flux is often zero, in which case the radiation components are the dominant causes of temperature changes. Predictive methods for the two radiation components were developed as a function of meteorological parameters alone (temperature, humidity, cloudiness, opaqueness). These predictive methods can be used in areas where there are no records of radiation measurements, because the required meteorological variables are commonly measured near by. A better predictive equation was found for shortwave radiation than for longwave radiation. Use of the shortwave equations in evaluating temporal temperature changes in a Florida lake resulted in good agreement with measured values. A tabulation of 148 days of hourly radiation and meteorological values is included in the report. (Knapp-USGS)
W71-05450

TWELFTH CONFERENCE ON GREAT LAKES RESEARCH,
Michigan Univ., Ann Arbor. Great Lakes Research Div.; and Bureau of Commercial Fisheries, Ann Arbor. Great Lakes Fishery Lab.
David C. Chandler, and George Y. Harry.
Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, 1969. 923 p.

Descriptors: *Conferences, *Limnology, *Great Lakes, Lake Superior, Lake Huron, Lake Michigan, Lake Ontario, Lake Erie, Water pollution effects, Bottom sediments, Sedimentation, Sampling, Water quality, Water balance, Water resources development, Water management (Applied).
Identifiers: Great Lakes Research Conference.

The Twelfth Conference was held May 5-7, 1969, at Ann Arbor, Michigan, co-hosted by the Great Lakes Fishery Laboratory of the U.S. Bureau of Commercial Fisheries and the Great L
Research Division of the University of Mich
Emphasis in the general sessions was on
resource values of the Great Lakes and their r
the national program of marine science. Aut
ties at the regional and national levels from Ca
and the United States were participants in
general sessions. Contributed papers covere
usual scientific disciplines in addition to sp
topics such as: resource management
economics; water management; limnologica
gineering; and physical lake models. The sym
were on quaternary history of the Great Lak
gion, pesticides and the Great Lakes, the pot
application of remote sensing to Great L
problems, and instrumentation for studies in p
cal limnology. (See also W71-05562 thru
05571) (Knapp-USGS)
W71-05561

NEARSHORE SEDIMENT SURVEY WESTERN LAKE ONTARIO, METHODS PRELIMINARY RESULTS,
Department of Energy, Mines and Resou
Burlington (Ontario). Canada Center for I
Waters.
For primary bibliographic entry see Field 02J.
W71-05562

GEOCHEMISTRY OF LAKE MICHIGAN M GANESE NODULES,
Michigan Univ., Ann Arbor. Great Lakes Res
Div.
Ronald Rossmann, and Edward Callender.
In: Proceedings Twelfth Conference on
Lakes Research, May 5-7, 1969, Universi
Michigan, Ann Arbor: International Associ
for Great Lakes Research, p 306-316, 1969. 1
fig, 6 tab, 14 ref. FWQA Grant WP-00311
Grant GA 1337.

Descriptors: *Geochemistry, *Manganese, *
Michigan, *Bottom sediments, Provenance,
chemistry, Chemical precipitation, Iron, Sedi
tation, Sediment-water interfaces, Organic m
Leaching, Oxidation-reduction potential,
Lakes.
Identifiers: Green Bay (Lake Michigan).

Manganese nodules, similar in compositio
other freshwater and shallow marine no
occur on the sediment surface of Green Ba
northern Lake Michigan. Samples have
analyzed for their iron, manganese, calcium,
nesium, sodium, potassium, inorganic carbo
ganic carbon, and total nitrogen content.
nodules average 20% iron and 6% manganese
trace metal content (copper, zinc, cobalt,
nickel) of the samples is considerably lower
that of marine material. Interstitial water is o
the major contributors of manganese and iro
the growth of nodules in Lake Michigan. Co
Green Bay sediment show an inverse relatio
between sedimentary and interstitial mang
with the sedimentary manganese increasing
maximum at or near the sediment-water inte
Sedimentary iron remains fairly co
throughout the length of these cores while in
tial iron decreases slightly toward the sedi
water interface. In addition, lake water m
more than a passive contributor of iron and
ganese. There are indications that as much as
half of the manganese found in lake water i
ticulate. The source of this material is believ
be the iron deposits of the Canadian Shield
have been subsequently leached of manganes
iron. (See also W71-05561) (Knapp-USGS)
W71-05563

PROFILES BETWEEN MANITOULIN ISL AND TOBERMORY (BRUCE PENINSULA),
Huntec Ltd., Toronto (Ontario).
J. W. Prior.
In: Proceedings Twelfth Conference on
Lakes Research, May 5-7, 1969, Universi
Michigan, Ann Arbor: International Associ

Great Lakes Research, p 300-305, 1969. 6 p, 4
3 ref.

scriptors: *Profiles, *Sounding, *Seismic stu-
s, *Bathymetry, *Lake Huron, Bottom sedi-
nts, Topography, Sedimentation, Cores,
mpling, Great Lakes.
ntifiers: Georgian Bay (Lake Huron).

o hydrographic and seismic profiles were run in
e Huron between Tobermory and Fitzwilliam
nd as part of a pipe line feasibility study. The
ly showed that the shortest course was unsuita-
with many rock ledges on lake bottom. A more
erly course showed a predominantly sediment
ered lake floor. A gorge within the bedrock east
Yeo Island is observed to trend and deepen to
north east. (See also W71-05561) (Knapp-
GS)
1-05564

GANIC MATTER IN THE SEDIMENTS OF
KES ONTARIO AND ERIE,
artment of Energy, Mines and Resources,
lington (Ontario). Canada Center for Inland
ers.
primary bibliographic entry see Field 02J.
1-05565

ALYSIS OF SEDIMENT CORES FROM BIG
SCAMOOT BAY AND GOOSE BAY IN THE
CLAIR RIVER DELTA,
ne State Univ., Detroit, Mich.
primary bibliographic entry see Field 02J.
1-05566

H RESOLUTION REFLECTION SEISMIC
VEY IN WESTERN LAKE ERIE,
logical Survey of Canada, Ottawa (Ontario);
logical Survey of Canada, Burlington (On-
); and Ohio State Geological Survey, San-
y.
rge D. Hobson, C. E. Herdendorf, and C. F. M.
is.
Proceedings Twelfth Conference on Great
es Research, May 5-7, 1969, University of
higan, Ann Arbor: International Association
Great Lakes Research, p 210-224, 1969. 15 p, 9
3 ref.

criptors: *Surveys, *Bathymetry, *Seismic stu-
*Stratigraphy, *Lake Erie, Bottom sediments,
ial drift, Sounding, Ohio, Topography,
iles, Great Lakes.
tifiers: *Seismic survey (Lake Erie).

Geological Survey of Canada, in cooperation
the Ohio Geological Survey, undertook a con-
ous marine seismic profiling survey in the
ern part of Lake Eric during August-Sep-
er 1968. Seismic coverage, totalling 818 mi,
obtained approximately every 5 minutes of
de and longitude west of Point Pelee in both
dian and United States waters. Record quality
s considerably over the survey area. East of
and Kelleys Islands, data are good and pro-
a reliable interpretation of thickness of bottom
nents and stratification within them. The
rnmost portion of the basin, yields poor data;
s probably due to gaseous organic material,
bodies, or buried peat deposits. Drift
ness from drill holes and from the survey cor-
well and range from zero up to 120 ft. A
r reflector within the drift indicates the sur-
of glacial deposits and the general pattern of
glacial and postglacial drainage during low-
phases of Lake Erie. Offshore bedrock eleva-
varies between 390 and 571 ft above sea level.
ock highs underlie Point Pelee and the islands
eas bedrock lows in inter-island areas and the
al basin are readily outlined. An interpreta-
of preglacial drainage is presented. (See also
-05561) (Knapp-USGS)
-05567

CHARACTERISTICS OF LAKE MICHIGAN BOTTOM PROFILES AND SEDIMENTS FROM LAKESIDE, MICHIGAN TO GARY, INDIANA,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02J.
W71-05568

SEDIMENTS AND GEOLOGY OF BOIS BRULE RIVER, WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-05569

GEOCHEMICAL CHARACTERISTICS OF LAKES MICHIGAN AND SUPERIOR SEDIMENTS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 02J.
W71-05570

MONTHLY VARIATION IN PHOSPHATE AND RELATED CHEMICALS FOUND IN THE SEDIMENT IN THE ISLAND AREA OF LAKE ERIE, 1967-68, WITH REFERENCE TO SAMPLES COLLECTED IN 1964, 1965, AND 1966,
John Carroll Univ., Cleveland, Ohio; and Ohio State Univ., Columbus.
For primary bibliographic entry see Field 05A.
W71-05571

CHEMICAL COMPOSITION OF SOME INLAND SURFACE WATERS AND LAKE DEPOSITS OF NEW SOUTH WALES, AUSTRALIA,
Monash Univ., Clayton (Australia). Dept. of Zoology.
W. D. Williams, K. F. Walker, and G. W. Brand.
Australian Journal of Marine and Freshwater Research, Vol 21, No 2, p 103-116, December 1970. 14 p, 2 fig, 5 tab, 25 ref.

Descriptors: *Water chemistry, *Lakes, *Salinity, Arid lands, Brines, Water quality, Sampling, Data collections, Phosphates, Nitrates, Chlorides, Sedium, Bicarbonates, Sulfates.
Identifiers: *Australia, *New South Wales (Australia).

Chemical data are presented for several lakes and two impoundments on the Kosciusko and Monaro plateau in south-eastern New South Wales, Australia, and for two rivers (Paroo and Darling), several freshwater lakes, and deposits from some dry salt lakes in western New South Wales. The concentrations of the major cations and anions, nitrate, and orthophosphate were investigated. For lake deposits, only major ions were investigated. The Kosciusko lakes were extremely fresh and chemically dominated by sodium and either bicarbonate, chloride or sulphate ions; the Monaro peneplain lakes had a considerable salinity range (69-21,244 p.p.m.), and, with increasing salinity, sodium and chloride assume dominance. The Paroo and Darling Rivers had salinities less than 400 p.p.m. and the western freshwater lakes less than 850 p.p.m.; in both rivers and lakes, sodium and bicarbonate were the dominant ions. Deposits from dry salt lakes were mainly sodium chloride. (Knapp-USGS)
W71-05616

SEDIMENT-WATER NUTRIENT RELATIONSHIPS - PARTS 1 AND 2,
Federal Water Quality Administration, Cincinnati. Field Investigations Branch.
For primary bibliographic entry see Field 05B.
W71-05626

BANGIA ATROPURPUREA (ROTH) A. IN WESTERN LAKE ERIE,
Ohio State Univ., Columbus. Dept. of Botany.
For primary bibliographic entry see Field 05A.
W71-05630

2I. Water in Plants

POTENTIAL USEFULNESS OF ANTITRANSPIRANTS FOR INCREASING WATER USE EFFICIENCY IN PLANTS,
California Univ., Davis. Water Resources Center.
Robert M. Hagan, and David C. Davenport.
Available from NTIS as PB-197 930, $3.00 in paper copy, $0.95 in microfiche. California University Water Resources Center Technical Completion Report W-174, December 1970. 66 p, 27 fig, 26 tab, 30 ref. OWRR Project B-054-CAL (1).

Descriptors: *Water conservation, *Soil-water-plant relationships, *Evapotranspiration control, *Transpiration control, Plants, Chemcontrol, Thin films, Application methods, Water loss, Moisture content, Retardants, Surface tension, Hydrometry, Photosynthesis, Vegetation, Leaves, Consumptive use.
Identifiers: Water balance control (Plants).

Antitranspirants conserve water and maintain favorable plant water balances by reducing stomatal apertures, by forming a thin film over the leaves, or by reflecting excessive radiation. Under normal conditions, reductions in both transpiration and photosynthesis are to be expected, but reduction in growth does not always occur, and need not always be disadvantageous when it does. Antitranspirant effects on stomata were judged indirectly by porometry (mass flow or rate hygrometer), and directly by microscopic measurement of stomatal apertures from epidermal peels. The relationship between diffusive resistance and stomatal aperture was determined. It was found that a film antitranspirant, by increasing plant water potential, actually increases the aperture of stomata lying immediately under it. Direct stomatal measurements enabled assessment of the effects of the stomatal-closing antitranspirant, phenylmercuric acetate (PMA). It was discovered that PMA not only retards stomatal opening, but also retards closure, thereby increasing transpiration under conditions of low light or low water supply. The effects of various alkenylsuccinic acids (stomatal-closing antitranspirants which do not contain heavy metals) on the rates of transpiration and photosynthesis were measured. (Woodard-USGS)
W71-05443

PRODUCTION, CRUDE PROTEIN, AND USE OF 11 IRRIGATED GRASSES AND ALFALFA-GRASS COMBINATIONS ON CLAY SOILS IN WESTERN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Range Management.
For primary bibliographic entry see Field 03F.
W71-05464

SELECTED CHARACTERISTICS OF REPRESENTATIVE IRRIGATED AND DRY-LAND FARMS AND RANCHES IN THE BELLE FOURCHE AREA,
Economic Research Service, Brookings, S. Dak.
For primary bibliographic entry see Field 03F.
W71-05466

VEGETATION COMPARISONS BETWEEN THE MEDITERRANEAN CLIMATIC AREAS OF CALIFORNIA AND CHILE,
Stanford Univ., Calif. Dept. of Biological Sciences.
H. A. Mooney, E. L. Dunn, Frances Shropshire, and Leo Song.
Supported by the NSF (GB 5223 and GB 8184) and the Ford Foundation's University of California-University of Chile Convenio. Flora, Vol 159, No 5, p 480-496, 1970. 3 fig, 3 tab, 25 ref.

Descriptors: *Plant populations, *Climatic zones, *Vegetation, *Shrubs, *Trees, Arid lands, Semiarid climates, Temperature, Precipitation (Atmospheric), Soil moisture, Environmental effects,

Ecology, Drought tolerance, Xerophytes, Habitats, Gradation, Distribution, Moisture availability, Geographical regions, Biological communities, California, Comparative productivity, Altitude, Forests.
Identifiers: *Chile, *Mediterranean climates, *Evergreens, *Succulents.

The Mediterranean regions of the world are widely separated and have taxonomically quite unrelated floras. However, they possess vegetations with comparable functions and physiognomies. In terms of climatic gradients, topographic configurations and land-use histories, Chile and California are the most comparable Mediterranean-Climatic regions, thus facilitating extremely direct vegetation comparisons. Both areas have the same general vegetation gradients. Going from the mesic to the arid end of the climatic gradient, homologous plant community types occur: closed evergreen forest, dense evergreen scrub, low scrub with many drought-deciduous elements and low scrub with many succulents. There are no common genera between the 2 regions, making clear that any structural similarities must be due to evolutionary convergence. Precipitation gradients extended from 80-1600 mm and latitudes spanned from 30-43 deg. There is a remarkable alignment of homologous community types with equal low elevation climatic regions. The very arid areas have sparse vegetation composed of slow-growing succulents and a diversity of drought-evading and enduring forms. With somewhat less aridity, the dominant forms are drought deciduous shrubs. Only evergreens that are very specialized occur. At the evergreen scrub level, soil water is available at depth, hence most shrubs are deep-rooted. Internal convergence is highest at this level but there is a degree of discordance between California and Chile. Low evergreen scrub in Chile has more drought-deciduous elements than California. Also, the rich Montane forests of the Sierra Nevada are lacking in the Andes. There are also equal latitudinal replacements of community types. (Casey-Arizona)
W71-05470

EFFECTS OF ENVIRONMENT ON RELATIONS BETWEEN EXTENSION AND CAMBIAL GROWTH OF POPULUS EUPHRATICA OLIV.,
Tel Aviv Univ. (Israel). Dept. of Botany.
Nili Liphschitz, and Yoav Waisel.
New Phytologist, Vol 69, No 4, p 1059-1064, October 1970. 2 fig, 1 tab, 8 ref.

Descriptors: *Cottonwoods, *Soil-water-plant relationships, *Plant growth, *Environmental effects, *Xylem, Plant tissues, Vascular tissues, Trees, Mode of action, Ecology, Slopes, Canyons, Regression analysis, Semiarid climates, Correlation analysis, On-site data collections, Equations.
Identifiers: *Israel, *Cambium, *Shoots.

P. euphratica, a native of Israel, exhibits several growth processes and a wide variety of wood types. Twenty-one adult trees growing on the eastern slope of a canyon near a stream were measured for annual increments of shoot elongation for several years in an effort to establish relationships between shoot elongation and cambial initiation in diffuse and ring porous trees. The habit was classified by levels on the basis of water supply: (1) water level; (2) mid-level, wet; (3) mid-level, dry and (4) slope level, dry. Growth was compared among trees at the various levels. Regressions of annual increment were performed on width of the current ring, width of the former extension increment ring, and mean width of annual extension growth. Shoot elongation of trees on dry sites was restricted and associated with narrow annual rings and ring porous wood. On wet sites, vigorous shoot growth was associated with wide annual rings and diffuse porous wood. Cambial growth characteristics are clearly correlated with shoot elongation and environmental influences are indirect. (Casey-Arizona)
W71-05471

RADIAL WATER AND SOLUTE FLOWS IN ROOTS OF ZEA MAYS; II. ION FLUXES ACROSS ROOT CORTEX,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
H. Ginsburg, and B. Z. Ginzburg.
Supported by US Department of Agriculture Grant FG-IS-191, Project No A10-SWC-31. Journal of Experimental Botany, Vol 21, No 68, p 593-604, August 1970. 5 fig, 7 tab.

Descriptors: *Tracers, *Ion exchange, *Ion transport, *Root systems, *Estimating equations, Anion exchange, Cation exchange, Chlorides, Sodium, Potassium, Calcium, Phosphates, Water balance, Mode of action, Laboratory tests, Plant physiology, Absorption, Metabolism, Permeability, Membrane processes, Flow, Flow measurement, Radiochemical analysis, Instrumentation, Cytological studies.
Identifiers: *Metabolic inhibitors, *Reflection coefficients, *Osmotic flow.

Unidirectional radial fluxes of tagged Na, Cl and phosphate ions were measured across root 'sleeve' preparations. Since these preparations are extremely similar to epithelial preparations such as frog skin, active and passive ionic movements could be differentiated by use of the Ussing flux equations. At any given concentration, cation fluxes were 1 to 3 orders of magnitude greater than anion fluxes. The flux ratios indicated cation movement was largely passive while anion movement was dependent upon active cell pumping. The Cl influx was inhibited by KCN and increased by DNP, while K fluxes were unaffected by both metabolic inhibitors. Steady-state flux equations yield permeability coefficient values from which apparent diffusion coefficient values may be calculated. The resulting data indicate that radial ion movements must be through, rather than between, root cells. Anion movements are probably linked to the electron-flow system and not to ATP. Data must be interpreted cautiously, however, in view of endodermal damage. (Casey-Arizona)
W71-05474

PROSPECTS FOR PHOTOSYNTHESIS FROM A.D. 1970 TO A.D. 2000,
Nottingham Univ. (England). Dept. of Physiology and Environmental Studies.
J. L. Monteith.
Weather, Vol 25, No 10, p 456-462, October 1970. 1 fib, 2 tab, 9 ref.

Descriptors: *Photosynthesis, *Carbon dioxide, *Aerosols, *Solar radiation, Estimating equations, Respiration, Crop response, Oceans, Productivity, Atmosphere, Forecasting.
Identifiers: *Insolation, Dry matter.

The rate at which world dry matter is being accumulated at any given time is dependent upon the balance between photosynthate production and it's loss by respiration. Production (Photosynthetic rate) depends upon water, carbon dioxide and solar radiation in the 0.4-0.7 micrometer waveband. It is usually independent of temperature between 10-30C. Respiration rate depends upon the current amount of dry matter accumulated by the plant, photosynthetic rate and temperature. Using projected figures for carbon dioxide release into the atmosphere and assuming two-thirds of it will dissolve into the oceans, it is calculated that the atmospheric content will increase from the current level of 314 p.p.m. to 380 p.p.m. by 2000 A.D. The evidence for insolation decrease by particular scattering is conflicting. Therefore, the estimates of photosynthesis in 2000 A.D. were calculated for 2 plausible cases: (1) Carbon dioxide increasing to 380 p.p.m.; insolation constant; (2) carbon dioxide increasing to 380 p.p.m. and insolation decreasing by 1%/yr. Using condition (1) calculations indicate a 9% increase in gross photosynthesis between 1970-2000. Using (2), there should be a 0% change. Although the figures in themselves should cause no alarm, the author warns a number of contingencies. Even with a 9% increase, population growth will consume the added crop production. Further, changes in the Earth's heat balance could increase respiration, thereby decreasing productivity. It is stressed that such long-term dictions are extremely unreliable. (Casey-Ariz
W71-05475

TERRESTRIAL DESERT ARTHROPO FAUNA AND ECOLOGY,
Tennessee Univ., Knoxville. Dept. of Zoology Entomology.
Ronald R. Shmoller.
The Biologist, Vol 52, No 3, August 1970, p 7
2 fig, 28 ref.

Descriptors: *Deserts, *Insects, *Ecology, *In tors, *Environmental effects, Heat resista Diapause, Microenvironment, Insect resista Entomology, Animal physiology, Insect beha Environment, Drought tolerance.
Identifiers: *Species, *Adaptation, Namib Des

This paper examines the environmental rela ships of terrestrial desert arthropods. The ta both the North American deserts and the N Desert of southwest Africa indicate very periods of adaptation to desert conditions. Nur cally dominant desert arthropods are mites, pions, spiders, grasshoppers, true bugs, hor terans, bettles, flies, and hymenopterans. O worldwide indicator species for deserts, pos the best are the darkling beetles. Others are s gids, robber flies, beeflies, and some cockroa Less important indicators are also given. desert arthropods are nocturnal or crepusc and the season of activity often coincides moist periods. Many enter diapause to avoid hot, or cold seasons. Many desert arthropod burrowers, and larvae often live in the soil or u rocks. Adaptations of desert-inhabiting arthro include lack of need for drinking water, waxy cle, urtocotelic excretory system, color ad tions, dense pubescence, reflective cuticle, elytral air spaces, thick exoskeleton, large size, legs, high temperature tolerance, behavioral a tations to heat, flightless adaptation to wind treme agression in carnivores, and the abili survive for long periods without food. (Ye Arizona)
W71-05478

INTERRELATIONS BETWEEN GROWTH PHOTOSYNTHESIS OF SALTBUSH (ATRIP HALIMUS L.) GROWN IN SALINE MEDIA,
Hebrew Univ., Jerusalem (Israel). Dept. of Bot
J. Gale, and A. Poljakoff-Mayber.
Supported by U.S. Department of Agricu Grant (PL-480, Project No A10-SWC-7).
tralian Journal of Biological Sciences, Vol 23 5, p 937-945, October 1970. 4 fig, 1 tab, 15 ref

Descriptors: *Halophytes, *Plant gro *Photosynthesis, *Salinity, *Osmotic pres Xerophytes, Laboratory tests, Transpiration, physiology, Carbon dioxide, Sodium chlo Sodium sulfate, Leaves, Stomata, Plant morph gy, Resistance, Salts, Absorption.
Identifiers: *Succulence, *Leaf area, *W potential, *Leaf mesophyll.

Some Atriplex species may require small amo of salt for optimum growth. A study was ma the growth of A.halimus under various saline ditions, in which the effects of NaCl and Na su in the nutrient media were compared. Accomp ing changes in leaf transpiration and photosynt were also measured. Either salt at low conce tions in the growth media stimulated total leaf succulence and overall growth. At osmotic sures less than -5 atm, growth depression resu Salinity responses apparently operated throug ferent mechanisms, since sap osmotic potenti NaCl-exposed plants underwent osmostic a ment while the Na sulfate-exposed plants sh only a partial osmotic adjustment. As salinit creased, stomatal resistance to water loss and bon dioxide uptake increased, offsetting the salinity beneficial effects of greater leaf su area for transpiration and photosynthesis.

NaCl concentrations and all Na sulfate concentrations increased mesophyll resistance to carbon dioxide uptake, which also acted to decrease photosynthesis. Finally, as salinity increased, lateral bud sprouting increased, implying a reduction in apical dominance. Possibly salinity disrupted plant hormonal balance. (Casey-Arizona)
W71-05480

GENETIC PROBLEMS OF HOT DESERT POPULATIONS OF SIMPLE TECHNOLOGY,
Newcastle-upon-Tyne Univ., (England). Lab. of Human Genetics.
D. F. Roberts.
Contribution to a Symposium on Climatic challenge and Population Pressure, London, 30 November 1968. Human Biology, Vol 42, No 3, p 469-485, September 1970. 4 fig, 24 ref.

Descriptors: *Arid lands, *Genetics, *Social aspects, *Cultural control, *Water shortage, Social behavior (Animals), Environmental effects, Mode of action, Ecology, Human population, Human resources, Biomass, Habitats, Animal behavior, Food chains.
Identifiers: *Adaptation, *Australia, *Aborigines.

Human inhabitants of hot deserts are pictured as carnivores on top of a fragile food chain limited in biomass because of limitations in plant growth. The mechanism of survival of primitive technology populations in hot deserts is universal--the use of some animal intermediary, whether hunted or herded, which is adapted to survival on meager desert resources. It follows that human desert populations must be small and mobile. Mammal home range sizes as functions of body weight and basal metabolism are considered, and human population density as a function of rainfall is quantitized. The survival of human desert populations may involve either or both of the phenomena of developmental adaptations or genetic adaptations. The genetic adaptations involve 4 interacting component problems: (1) habitation of extreme environments; (2) colonizing populations; (3) migrant populations; (4) small scattered populations. The problems are outlined, but unfortunately, critical data for their resolution are lacking. The intensity of selection is unknown and therefore the extent of polymorphism in desert populations is problematical. A consideration of colonization presents the problem of defining appropriate components of fitness, leasing to the apparent paradox of selection against high fertility. The small populations have theoretical genetic inbreeding problems, but this may be compensated for by cultural factors which mitigate against excessive inbreeding while maintaining high genetic drift possibilities. (Casey-Arizona)
W71-05481

CHLORIDE INFLUX INTO CITRUS LEAF SLICES,
South Australian Dept. of Agriculture, Adelaide; and Adelaide Univ. (Australia). Dept. of Botany.
J. B. Robinson, and F. A. Smith.
Supported by grants from the Australian Research Grants Committee and the Citrus Industry Research Trust Fund. Australian Journal of Biological Sciences, Vol 23, No 5, p 953-960, October 1970. 8 fig, 2 tab, 18 ref.

Descriptors: *Citrus fruits, *Leaves, *Chlorides, *Metabolism, *Inflow, Plant physiology, Osmotic pressure, Sodium, Potassium, Calcium, Sulfates, Energy transfer, Laboratory tests, Mode of action, Salinity, Tracers, Radiochemical analysis, Irrigation effects, Ions, Nitrogen, Sodium chloride, Cation adsorption, Anion adsorption.
Identifiers: *Citrus plants, *Cations, Anions.

Leaf material may be sampled and analyzed as a means of assessing the state of the whole plant with respect to detrimental ions or nutrients. Freshly cut citrus leaf tissue (Citrus sinensis) was sliced, rinsed and incubated in standard experimental solutions containing 0.5 mM Ca sulfate and NaCl at concentrations between 0.1-100 mM. Radioactive chloride ions were used and chloride influxes into the slices were measured after 2 hrs. Cl uptake from 10mM NaCl was linear over the 2 hr., increased with mounting external Cl concentration, and was increased by increasing accompanying Na or K ion concentrations. Influxes were little affected in the dark as opposed to the light, but under anaerobic conditions, they declined steeply. The metabolic inhibitor, DNP, which uncouples respiration, inhibits influx under aerobic conditions, regardless of light. A high concentration of CMU, which prevents non-cyclic electron flow, was needed to reduce influx in the light under nitrogen. These results suggest that: (1) anion and cation influx mechanisms cannot be separated; (2) Cl influx is linked to oxidative phosphorylation, but cyclic photophosphorylation may provide an alternate energy supply and (3) there is no evidence for 2 distinct Cl transport systems. The data also explains the phenomenon of slower onset of salinity damage to citrus trees by water containing NaCl when they are spray-irrigated at night. (Casey-Arizona)
W71-05482

GEOGRAPHICAL REGULARITIES IN THE PRODUCTIVITY AND THE CIRCULATION OF CHEMICAL ELEMENTS IN THE EARTH'S MAIN VEGETATION TYPES,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut; and Akademiya Nauk SSSR, Moscow. Botanicheskii Institut.
N. I. Bazilevich, and L. Ye. Rodin.
Soviet Geography: Review and Translation, Vol 12, No 1, p 24-53, January 1971.

Descriptors: *Biomass, *Biological communities, *Vegetation, *Productivity, Climatic zones, Nutrient requirements, Distribution patterns, Environmental effects, Mapping, Tropical regions, Vegetation effects, Humus, Organic matter, Environmental gradient.
Identifiers: Chemical elements.

The mass of the biosphere is extremely small relative to the masses of the lithosphere on hydrosphere, and is composed mainly (Almost 99%) of phytomass. By virtue of constant recycling, living matter maintains a tremendous effect on geochemical processes despite its relatively small mass. The geochemical work of the phytomass may be described, dynamically, as the accumulation of matter and energy/unit time. The appropriate measurements are annual increment/unit area in the above-and underground plant communities, subdivided into structural elements. Indices of the amounts phytomass and dead organic matter give a static picture of the potential reserves of matter and energy accumulated by the plant community as of a given moment. Using a 10-point rating scale, the geographical distribution of potential productivity and of the biological circulation of the principal vegetation types is mapped and analyzed in terms of 6 parameters. From the arctic to equatorial Africa, phytomass magnitude forms a triple-crested sinusoidal distribution, with maxima occurring, from north to south, between arctic desert and broadleaf forest, between subboreal desert and subtropical forest and between subtropical and tropical rain forest except for a slight decrease at semiarid and arid steppes. Productivity is therefore not proportional to phtomass magnitude, but is associated with herbaceous woody and herbaceous communities. Annual growth and biological carring capacity and intensity increase steadily from tundra to coniferous forest to broadleaf forest and steppe, leaching maxima in the humid subtropics and tropics. In deserts, both productivity and carrying capacity are low, but the intensity of biological circulation is high. (Casey-Arizona)
W71-05483

NET AND SOLAR RADIATION RELATIONS OVER IRRIGATED FIELD CROPS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

For primary bibliographic entry see Field 02D.
W71-05622

DIFFERING SENSITIVITY OF PHOTOSYNTHESIS TO LOW LEAF WATER POTENTIALS IN CORN AND SOYBEAN,
Illinois Univ., Urbana. Dept. of Botany.
J. S. Boyer.
Plant Physiology, Vol 46, No 3, p 236-239, March 1970. 3 fig, 26 ref. OWRR Projects A-028-ILL (3) and B-036-ILL (7).

Descriptors: *Stomata, *Photosynthesis, *Drought tolerance, *Transpiration, *Metabolism, Leaves, Drying, Corn (Field), Soybeans, Carbon dioxide, Soil-water-plant relationships, Laboratory tests, Mode of action, Moisture stress, Water balance, Environmental effects, Temperature, Permeability, Diffusion, Boundary layers, Resistance, Inhibition.
Identifiers: *Water potential.

Some evidence has accrued for advancing the thesis that plant species having the 4-carbon dicarboxylic acid photosynthetic pathway are, for biochemical or morphological reasons, more drought resistant. Corn (Zea mays) and soybeans (Glycine max) were subjected to drought and photosynthetic and transpiration rates and leaf air permeabilities were measured at various levels of water potential. Diffusive resistances to carbon dioxide entry could be calculated. In corn, photosynthetic rates were inhibited at water potentials of -3 bars and photosynthesis ceased at -16 bars. The equivalent figures for soybeans were -11 and -41 bars. As leaf water potentials dropped, photosynthesis inhibition in both species did not occur until transpiration reduction and stomatal closure also occurred. Therefore, photosynthesis inhibition seemed dependent on stomatal behavior. Since corn has a 4-carbon photosynthetic pathway while soybeans do not, such a pathway does not seem to confer greater drought tolerance. However, at any given level of water potential down to -16 bars, corn photosynthetic rates were greater than those of soybeans, so the results must be carefully interpreted. (Casey-Arizona)
W71-05707

THE EDAPHIC ADAPTATION OF SOME CLOSELY RELATED CLOVERS,
Newe Yaar Experiment Station (Israel). Div. of Forage Crops and Pasture.
J. Katznelson.
Ecologia Plantarum, Vol 4, No 2, p 211-224, 1969. 1 fig, 5 tab, 15 ref. USDA Contract A10-CR-56.

Descriptors: *Clovers, *Soil-water-plant relationships, *Statistical methods, *Soil types, *Plant growth, Ecology, Environmental effects, Lavoratory tests, Legumes, Ecotypes, Soil analysis, Soil chemical properties, Soil classifications, Soil groups, Soil moisture, Soil properties, Variability, Alluvium, Basalts, Loam, Analytical techniques, Weight, Varieties, Crop response, Model studies, Data collections.
Identifiers: *Israel, *Analysis of variance, Grumosols, Lithosols, Rendzinas.

Trifolium is one of the world's largest plant genera. A group of species are native to Israel, Jordan, Syria and Lebanon and are usually distributed in relation to edaphic conditions. Whether the presence of a species in a given soil is incidental is not known. Five Trifolium species and 1 hybrid, alexandrinum, berytheum, vavilovi, carmeli, plebeium and pilulare X subterraneum were grown together in 10 different soil types, including basalts, heavy alluvial grumosols, light rendzinas, light brown lithosols and water logged sandy loams, and their growth characteristics were compared. The differences between species and between soils in weights of the upper parts of the plants were very large and statistical analysis showed that the variability depended on soil types and plant species that did not share a common variance. Compared to shoot weight, root weight differences due to species were much more conspicuous than differences due to soil. Some drastic differences in growth oc-

curred, and analyses of variance could not fit the data to either additive or multiplicative models, although the data did fit better to multiplicative models. Soil analyses confirmed that species varied in their ability to utilize favorable edaphic conditions. (Casey-Arizona)
W71-05708

WATER BALANCE IN LEAF TISSUE,
Ceskoslovenska Akademie Ved, Prague. Ustav Experimentalni Botaniky.
For primary bibliographic entry see Field 02D.
W71-05709

THE PARTITIONING OF RESISTANCES TO PHOTOSYNTHETIC CARBON DIOXIDE UPTAKE IN THE LEAF,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
Dov Koller.
AGC Contract AT (04-1) GEN-12. New Phytologist, Vol 69, No 4, p 971-981, October 1970. 5 fig, 1 tab, 9 ref.

Descriptors: *Resistance, *Carbon dioxide, *Photosynthesis, *Leaves, *Absorption, Theoretical analysis, Model studies, Stomata, Structure, Plant morphology, Plant physiology, Diffusivity, Epidermis, Mode of action, Transpiration, Analog models, Plant tissues, Resistance networks, Boundary layers.
Identifiers: *Water potential, *Leaf mesophyll, *Leaf anisolaterality.

The liquid phase in a leaf will tend to remain at a uniform water potential, preventing development of concentration differences in the vapor phase. By contrast, leaf tissues differ in their ability to fix carbon dioxide and in boundary layer, epidermal and pathway resistances to carbon dioxide diffusion. It follows that transpiration is not limited by any intercellular pathway resistance, but that photosynthesis is likely to be greatly affected. The various resistances to carbon dioxide may be fractionated into subcomponents and treated algebraically as electrical resistances. Taking into account resistances involving mesophyll resistances in the upper and lower chlorenchyma and resistance between the upper and lower leaf layer including leaf anisolaterality, an electrical analogue model was constructed to show the partitioning of overall resistance to photosynthetic carbon dioxide uptake in a bilateral leaf. Mesophyll component resistance is usually calculated by subtracting diffusional resistance component from total carbon dioxide uptake resistance. Calculations show that considerable error arises in the estimation of mesophyll resistance when internal diffusion and epidermal and/or mesophyll anisolaterality are neglected. Using parallel chambers and a diffusion porometer, the appropriate parameters may be measured and used to correct mesophyll resistance calculations. As the mesophyll resistance increases, component error factor resistances decrease relatively. (Casey-Arizona)
W71-05713

GROWTH OF ATRIPLEX HALIMUS L. IN SODIUM CHLORIDE SALINATED CULTURE SOLUTIONS AS AFFECTED BY THE RELATIVE HUMIDITY OF THE AIR,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
J. Gale, R. Naaman, and A. Poljakoff-Mayber.
USDA Project No A10-SWC-7. Australian Journal of Biological Sciences, Vol 23, No 5, p 947-952, October 1970. 7 fig, 10 ref.

Descriptors: *Humidity, *Salinity, *Plant growth, *Environmental effects, *Physiological ecology, Leaves, Halophytes, Xerophytes, Osmotic pressure, Sodium chloride, Mode of action, Laboratory tests, Vapor pressure, Turgidity, Growth chambers, Arid climates, Humid climates, Climatology.
Identifiers: *Relative humidity, *Seedlings, *Water potential.

It has been shown that A. halimus plants in the laboratory demonstrate varying patterns of growth and physiological behavior in response to salinity differences, just as plants in the wild show varying patterns with season. In attempting to establish and interdependence between climatic and salinity effects, one climatic parameter--relative humidity (RH)--was examined. Two groups of seedlings were grown under identical climatic conditions in growth chambers, except that 1 group was exposed to about 65% RH and the other to about 27% RH. Each group was subdivided according to salinity media osmotic pressures, ranging from 0 to -20 atm. The plants showed very apparent differences in growth under the 2 conditions of humidity. (1) Dry-air plants showed maximum growth curves at -5 atm while humid-air plants showed a steady growth decline from a 0 atm optimum. (2) Plants grown with no NaCl (0 atm) in the humid chamber had a low fresh weight/dry weight ratio which showed an optimum at -3 atm, while the optimum for low humidity occurred at-10 atm. (3) Dry-air plants achieved less turgor and height at 0 atm, but equaled humid-air plants grown at the same salinity when osmotic potentials were -5 atm or less. (4) NaCl reduction of leaf weight/stem weight was greater in humid-grown plants. It is possible that microquantities of NaCl present as impurities may have been essential for growth even in high-humidity plants. The results suggest possible explanations for plant distribution, such as the absence of halophytes in the arid non-saline areas of the Mediterranean region. (Casey - Arizona)
W71-05714

THE INHIBITION OF FLOWERING BY WATER STRESS,
Adelaide Univ. (Australia). Waite Agricultural Research Inst.
D. Aspinall, and I. Husain.
Supported by the U.N. Arid Zone Research Program and the Australian Barley Improvement Trust Fund. Australian Journal of Biological Sciences, Vol 23, No 5, p 925-936, October 1970. 6 fig, 3 tab, 22 ref.

Descriptors: *Moisture stress, *Osmotic pressure, *Flowering, *Inhibition, *Leaves, Laboratory tests, Translocation, Mode of action, Plant physiology, Diurnal, Turgidity, Photoactivation, Plant growth, Water balance, Water requirements, Water utilization, Moisture deficit, Light, Photoperiodism.
Identifiers: *Water potential, *Induction, *Defoliation, *Apical morphogenesis, *Osmotic stress, Cotyledons, Psychrometers.

The inhibition of apical growth by water stress may be mediated through an inhibition of photoperiodically controlled floral induction. This may best be studied in single-cycle plants, such as Lolium temulentum, Pharbitis nil and Xanthium strumarium, where that inductive treatment can be clearly separated from floral development. When L. temulentum was subjected to osmotic stress during it's 16-hr. inductive photoperiod, osmotic stresses of -18 to -24 atm reflected by relative leaf turgidities of 75-78%, resulted in an inhibition of flowering. Osmotic stresses during the 16-hr. inductive dark period of P. nil decreased flowering at -2 atm and eliminated it at -6 atm. Creating stress by withholding water before the 16-hr. dark inductive period of X. strumarium had no effect if it was terminated before the inductive period, but eliminated flowering if it was continued through the inductive period--unless the stress was extremely severe. Indirect evidence suggests that floral stimulus is translocated from an induced lea, and that this process is disrupted by water stress. This was supported by flowering inhibition in plants defoliated during the inductive period. By contrast, mildly stressed plants that were not defoliated during the inductive period formed several flowers, indicating some stability of the floral stimulus during stress periods (Casey-Arizona)
W71-05715

2J. Erosion and Sedimentation

A CONSIDERATION OF POLLEN, DIATOMS AND OTHER REMAINS IN POSTGLACIAL SEDIMENTS,
Iowa State Univ., Dept. of Botany and Plant Pathology; and Iowa Lakeside Lab., Milford.
John D. Dodd, Ruth M. Webster, Gary Collins, and Larry Wehr.
Iowa Academy of Science Proceedings, Vol 75, p 197-209, 1968. 13 p, 5 fig, 2 tab, 15 ref. OWRR Project A-008-IA (2).

Descriptors: *Palynology, *Sediments, *Diatoms, *Pollen, *Iowa, Deposition (Sediments), Stratification, Lakes, Sedimentary structures, Diatomaceous earth, Sedimentation.
Identifiers: *Postglacial sediments, *Lake Okoboji (Iowa).

Pollen and diatoms in post-glacial sediments from a shallow bay of Lake Okoboji, Iowa, is considered. The presence of other microfossils is noted with emphasis on those of Cretaceous origin. Samples were dried at 100 deg C., weighed, and then separated into two portions, one for inorganic C determination and one for total organic matter determination. Samples were treated with trichloroacetic acid and weight loss was determined from liberation of CO2. From this the percentage of inorganic C was calculated. Organic matter determination was done by igniting samples in a 900-1000 deg muffle furnace for six hours per sample. Organic matter percentage was then calculated as the percentage of weight lost minus the inorganic C percentage. At the 27-foot level there is a well-defined population of diatoms which includes 22 genera and 66 taxa. The first appearance of diatoms may be more indicative of the beginnings of biological activity in a post-glacial lake than the presence of pollen which might be blown in from some distance. The pollen counts, from the top to the 27-foot level, indicate that no drastic change in the surrounding land vegetation occurred. (Woodard-USGS)
W71-05340

ORIGIN OF CLAY MINERALS IN A MID-ATLANTIC RIDGE SEDIMENT,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
R. A. Copeland, F. A. Frey, and D. R. Wones.
Earth and Planetary Science Letters, Vol 10, No 2, p 186-192, January 1971. 7 p, 3 fig, 2 tab, 25 ref. ONR Contract Nonr 1841 (74).

Descriptors: *Clay minerals, *Clays, *Bottom sediments, *Atlantic Ocean, *Provenance, Mineralogy, Sampling, Trace elements, Chemical analysis.
Identifiers: Rare earth elements.

The coarse and fine-grained mineral fractions of a Mid-Atlantic Ridge sediment (22 deg N) have been separated and analyzed for Fe and rare-earth elements (REE). Despite changes in Fe abundance, all the chlorites have REE distributions consistent with a derivation from ridge greenstones. The REE distribution of the fine-grained montmorillonite is similar to that of shales, yet differs markedly from that of a coarse locally derived iron-rich montmorillonite. A continental origin for the fine-grained montmorillonite is implied. (Knapp-USGS)
W71-05347

REMOVAL OF A SPHERICAL PARTICLE FROM A FLAT BED,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
Charng Ning Chen.
Georgia Institute of Technology Environmental Resources Center Report ERC-0770, November 1970. 96 p, 24 fig, 11 tab, 33 ref.

Descriptors: *Sediment transport, *Scour, Hydraulic models, *Tractive forces, Flow, Fluid friction, Hydrostatic pressure, Hydrodynamics, Hydraulic similitude, Statistical methods, Laboratory tests, Bed load.
Identifiers: *Hydrodynamic lift, *Sediment entrainment.

The mechanics of the process by which a sediment particle is removed from a stream bed was investigated by study of an idealized model, consisting of a one-inch diameter sphere protruding through a flat plate. By means of this model, the statistical variables of the angle of repose, the protrusion condition, and the approach velocity distribution became controllable at deterministic values. Initial motion of the particle is a fluctuating phenomenon which must be described in probabilistic germs because the fluid-dynamic force is fluctuating in nature. The transition from a stationary state to the removal of the spherical particle was found to be gradual rather than instantaneous. The transition is characterized by the random rocking motion of the sphere. The fluid-dynamic moments and forces were determined experimentally in air flow with both uniform and nonuniform approach velocity profiles. The ratio of the coefficient of lift to drag decreased from 1.6 to 0.4 as the ratio of the protrusion height to the sphere diameter increased from 25 percent to 100 percent. (Knapp-USGS)
W71-05350

FIELD TESTING OF THE IAEA PORTABLE RADIOISOTOPE SEDIMENT-CONCENTRATION GAUGE,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 07B.
W71-05352

A TROPICAL EXAMPLE OF TOPSOIL ENRICHMENT BY FLOOD SILT,
South Pacific Regional Coll. of Tropical Agriculture, Alafua (Western Samoa).
J. G. Reynolds.
Journal of Hydrology (New Zealand), Vol 9, No 1, p 32-35, 1970. 4 p, 1 tab, 6 ref.

Descriptors: *Floods, *Silts, *Organic matter, *Deposition (Sediments), *Fertilization, Silting, Sediments, Soil-water-plant relationships.
Identifiers: *New Zealand.

The sediments deposited during a flash flood estimated to have had a peak discharge of the order of 1000 cusecs are demonstrated to have considerably enriched the topsoil of several acres of productive valley alluvium. The probability that this is a recurring rejuvenation process is discussed. As the flood subsided a thin layer of fresh river silt was deposited over much of the valley bottom. In small local depressions this was 4-5 cm deep. As this layer dried out it developed the polygonal cracks typical of material with a high clay-silt content. The silt has a higher level of organic carbon and total nitrogen than the soil. In fact, some of the sediments had a thin black skin of organic matter on drying out. The individual exchangeable cations and cation-exchange are twice as high in the flood sediment as in the topsoil. These richer sediments were deposited over much of the area occupied by various vegetable test plots. Although some damage was caused by the flood, river sedimentation was in this case beneficial, because the rich sediments were deposited in thin layers which could easily be incorporated into the topsoil by plowing. (Knapp-USGS)
W71-05358

FAULKS V BOROUGH OF ALLENHURST (INSTALLATION OF SEWAGE TREATMENT PLANT ON PUBLIC ROAD EASEMENT).
For primary bibliographic entry see Field 06E.
W71-05403

TWELFTH CONFERENCE ON GREAT LAKES RESEARCH,
Michigan Univ., Ann Arbor. Great Lakes Research Div.; and Bureau of Commercial Fisheries, Ann Arbor. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 02H.
W71-05561

NEARSHORE SEDIMENT SURVEY OF WESTERN LAKE ONTARIO, METHODS AND PRELIMINARY RESULTS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
N. A. Rukavina.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 317-324, 1969. 8 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Bottom sediments, *Lake Ontario, *Surveys, Sampling, Profiles, Stratigraphy, Sounding, Cores, Provenance, Data collections, Erosion, Sedimentation, Currents (Water), Sediment transport, Great Lakes.
Identifiers: Niagara River.

Surface sediment samples, echo sounder profiles, and bottom observations by divers and with underwater television are used to map the sediments and bottom morphology of nearshore Lake Ontario (depth 0-20 m). In 1968 mapping was completed in western end of the Lake from Niagara on the south shore to Whitby on the north shore. Six bottom types are recognized and delineated: (1) bedrock 23%, (2) glacial drift 39%, and the recent sediments (3) gravel and pebbly sand 9%, (4) sand 12%, (5) silt-sand 10%, and (6) silt-clay 7%. Recent sediments occur: (1) on the south shore from Niagara to Jordan, (2) on the west shore opposite the Burlington Bar, and (3) on the north shore opposite Metropolitan Toronto. The deposits at Toronto and Niagara result from local erosion of shore bluffs; westward-moving longshore currents supply the sediment accumulating offshore from the Burlington Bar. (See also W71-05561) (Knapp-USGS)
W71-05562

ORGANIC MATTER IN THE SEDIMENTS OF LAKES ONTARIO AND ERIE,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
A. L. W. Kemp.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 237-249, 1969. 13 p, 4 fig, 2 tab, 24 ref.

Descriptors: *Bottom sediments, *Organic matter, *Lake Erie, *Lake Ontario, Cores, Sampling, Silts, Clays, Mud, Humic acids, Fulvic acids, Sedimentation, Paleoclimatology, Paleohydrology, Lakes, Sediment-water interfaces, Great Lakes.

Organic carbon and carbonate carbon were determined in six piston cores from Lake Ontario and four piston cores from Lake Erie. The changes in organic carbon with depth of burial are related to sediment type and Eh. Nitrogen, bitumens, humic acids, fulvic acids and kerogen were measured in three surface sediment samples from each Lake. The basin sediments of Lake Ontario consisted of black laminated grey silty clay muds overlying grey glacial clay, with mud thicknesses ranging from 4.6 to 13.8 m in the cores. Organic carbon content decreased 50% in the top 20 cm of sediment and then gradually decreased to 1% at the glacial clay contact. A complex organic carbon horizon was found two thirds of the way down the post glacial mud cloumn at each core station and was attributed to a warmer climate between 4000 and 7500 years BP. Bitumens accounted for 3 to 6% of the organic matter, humic and fulvic acids for 19 to 27% and kerogen for 35 to 49% in the surface centimeter of sediment, in the main basins of the two Lakes. (See also W71-05561) (Knapp-USGS)
W71-05565

ANALYSIS OF SEDIMENT CORES FROM BIG MUSCAMOOT BAY AND GOOSE BAY IN THE ST. CLAIR RIVER DELTA,
Wayne State Univ., Detroit, Mich.
Hugo Mandelbaum.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 271-299, 1969. 29 p, 12 fig, 12 tab, 7 ref.

Descriptors: *Bottom sediments, *Lakes, *Michigan, *Deltas, *Particle size, Variability, Cores, Statistical methods, Provenance, Sedimentation, Sediment transport, Sampling, Data processing, Data collections, Statistics, Great Lakes.
Identifiers: *Lake St. Clair, Muscamoot Bay.

Grain size analysis from sediment cores taken in the Big Muscamoot Bay and Goose Bay of the St. Clair River Delta show a great variability in the sediments. A variability index was defined and core parameters were constructed. The variability index has a log-normal distribution and is directly correlated to mean grain size of the sediment. Extent of the sedimentation area increases both mean grain size and variability. Higher order trend surfaces of the sediment parameters reveal strong trends in the direction of the bay axes but inconsistent trends across the bays. The amount of very coarse grains is large in the Outer Muscamoot Bay, more than 1.5% by weight. The investigated data suggest stable conditions since the beginning of deltaic sedimentation 12,000 years ago. (See also W71-05561) (Knapp-USGS)
W71-05566

HIGH RESOLUTION REFLECTION SEISMIC SURVEY IN WESTERN LAKE ERIE,
Geological Survey of Canada, Ottawa (Ontario), Geological Survey of Canada, Burlington (Ontario); and Ohio State Geological Survey, Sandusky.
For primary bibliographic entry see Field 02H.
W71-05567

CHARACTERISTICS OF LAKE MICHIGAN BOTTOM PROFILES AND SEDIMENTS FROM LAKESIDE, MICHIGAN TO GARY, INDIANA,
Army Coastal Engineering Research Center, Washington, D.C.
Eugene F. Hawley, and Charles W. Judge.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 198-209, 1969. 12 p, 6 fig, 21 ref.

Descriptors: *Bottom sediments, *Lake Michigan, *Indiana, *Sand bars, Beaches, Sands, Water circulation, Distribution patterns, Profiles, Currents (Water), Sedimentation, Provenance, Mineralogy, Particle size, Particle shape, Stratigraphy, Erosion, Scour, Beach erosion, Great Lakes.
Identifiers: Bottom profiles (Lake Michigan).

In order to evaluate the effects of lake levels and other factors on littoral processes the U.S. Army Corps of Engineers' Coastal Engineering Research Center is studying the southeastern shore of Lake Michigan from Lakeside, Michigan to Gary, Indiana, a distance of 34 mi. During 1966 and 1967 hydrographic profiles and approximately 500 sand samples were taken and analyzed. Profiles in the study area generally exhibit one or two offshore bars. Similar bars along this section of the coast have been previously described as stable; however, this study illustrates shifting from one year to the next. The profiles also indicate that accretion is predominant in the study area. Beach and bottom sediments in the study area are generally subround

quartz sand of various brownish tones with approximately 3n5% metamorphic (resistate) minerals; however, some coarse sediments contain nearly 100% rock fragments. Areally, sediment distribution trends follow the coastline and bathymetry and are stable from one year to the next. In general, medium sand predominates above waterline; the coarsest material occurs at the waterline. Offshore, medium and fine sands occur; fine sand is predominant. Littoral drift is toward the WSW. (See also W71-05561) (Knapp-USGS)
W71-05568

SEDIMENTS AND GEOLOGY OF BOIS BRULE RIVER, WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior. Dept. of Geology.
Albert B. Dickas, and Paul C. Tychsen.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 161-169, 1969. 9 p, 6 fig, 10 ref. OWRR Project A-023-WIS (6).

Descriptors: *Bottom sediments, *Lake Superior, *Provenance, *Wisconsin, Bed load, Sediment transport, Geology, Mineralogy, Mapping, Sands, Silts, Clays, Glacial drift, Sedimentation, Streamflow, Sediment load, Great Lakes.
Identifiers: *Bois Brule River (Wis).

A sedimentary analysis was made of the bed load of the Bois Brule River, Douglas County, Wisconsin to study the statistical characteristics of the clastic material and the Holocene sedimentation history of the Wisconsin shoreline of Lake Superior. The average mean size distribution of the clastic load, based on the phi scale, is 10% granules, 74% sand, 13% silt and 3% clay. To determine whether this dominantly sand-sized sediment was derived from basement rock or glacial debris, stream gravels larger than granule size were petrographically analyzed and compared to surficial and basement rock maps. The glacial cover is the prime source of the clastic material of the river load; mapping shows that outwash sands and reworked glacial drift predominate over much of the drainage area. A secondary source is outcropping Keweenawan (Cambrian) sandstones. The river load is deposited in Lake Superior out to a distance of 1/2 - 1 mile from the shoreline. (See also W71-05561) (Knapp-USGS)
W71-05569

GEOCHEMICAL CHARACTERISTICS OF LAKES MICHIGAN AND SUPERIOR SEDIMENTS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
Edward Callender.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 124-160, 1969. 37 p, 6 fig, 10 tab, 28 ref, 3 append. NSF Grants GA 1337 and GA 4507. FWQA Grant WP-00311.

Descriptors: *Bottom sediments, *Lake Michigan, *Lake Superior, *Water chemistry, *Sediment-water interfaces, Connate water, Mineralogy, Equilibrium, Ion exchange, Ion transport, Diagenesis, Geochemistry, Oxidation-reduction potential, Iron, Calcium, Magnesium, Sodium, Potassium, Manganese, Chlorides, Sulfates, Silica, Great Lakes.
Identifiers: *Sedimentary geochemistry.

More than 140 sediment samples from Lakes Michigan and Superior were analyzed for calcium, magnesium, iron, manganese, inorganic carbon, organic carbon, and total nitrogen content. Interstitial water from these same samples was analyzed for dissolved calcium, magnesium, sodium, potassium, iron, manganese, chloride, sulfate, and silica content. Most of the sedimentary calcium and magnesium is combined in the carbonate minerals calcite and dolomite. The remainder, especially magnesium, is associated with clay minerals. The instability of sedimentary carbonate minerals after burial is reflected in the significant increase of interstitial calcium and magnesium over lake water concentrations. Lake Michigan interstitial water is saturated with respect to calcite and dolomite while fluid from Lake Superior sediment approaches saturation with calcite but is undersaturated with respect to dolomite. Interstitial water from all lake sediments is in equilibrium with kaolinite and approaches saturation with respect to montmorillonite, chlorite, and amorphous silica. Essentially all sedimentary manganese originates in authigenic hydrated oxides. Sedimentary iron does not vary appreciably with depth in the sediment, while manganese increases significantly near the sediment-water interface. (See also W71-05561) (Knapp-USGS)
W71-05570

DEPOSITIONAL PROCESSES AND PRODUCTS IN THE DELTAIC ENVIRONMENT,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02L.
W71-05572

STRATIGRAPHY AND HISTORY OF THE HOLOCENE SEDIMENTS IN THE SABINE-HIGH ISLAND AREA, GULF OF MEXICO,
Mobil Research and Development Corp., Dallas, Tex. Field Research Lab.
For primary bibliographic entry see Field 02L.
W71-05573

THE MISSISSIPPI DELTA COMPLEX,
Esso Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 02L.
W71-05574

HOLOCENE GUADALUPE DELTA OF TEXAS GULF COAST,
West Virginia Univ., Morgantown, and Campbell Coll. Buies Creek, N.C., and Esso Standard Libya, Inc., Tripoli.
For primary bibliographic entry see Field 02L.
W71-05575

THE GOLDSBORO RIDGE, AN ENIGMA,
North Carolina State Univ., Raleigh. Dept. of Soil Science; and North Carolina Univ., Chapel Hill. Dept. of Geology.
R. B. Daniels, E. E. Gamble, and W. H. Wheeler.
Southeastern Geology, Vol 12, No 3, p 151-158, January 1971. 8 p, 3 fig, 2 ref.

Descriptors: *Sedimentary structures, *Sandbars, *Terraces (Geological), *North Carolina, *Coastal plains, Sands, Sedimentation, Erosion, Stratigraphy, Beaches, Berms, Geomorphology, Surfaces, Water levels.
Identifiers: *Goldsboro ridge (NC).

The Goldsboro ridge is a sand body 25 feet high that rises above the Sunderland surface near Goldsboro, North Carolina. It consists of unfossiliferous sands with a few intercalated clay beds. The ridge is neither an erosional outlier nor an eolian feature. It is a depositional ridge, probably of marine origin. The relationships among the height and orientation of the ridge, the elevation of the toe of the nearby Kenly scarp, the location of a distinctive slate knoll immediately northwest of the ridge, and the position and orientation of the Neuse and Little Rivers are all compatible with a marine origin. The Goldsboro ridge and the Kenly scarp are the major evidences of a former post-Miocene sea stand above 95 feet (Surry scarp). (Knapp-USGS)
W71-05578

HYDROLOGIC EFFECTS OF QUATERNARY SEDIMENTS ABOVE THE MARINE TERRACES IN THE GEORGIA COASTAL PLAIN,
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center.
Loris E. Asmussen.
Southeastern Geology, Vol 12, No 3, p 189-201, January 1971. 13 p, 7 fig, 15 ref.

Descriptors: *Aquifers, *Dunes, *Alluvium, *Georgia, *Coastal plains, Sedimentation, Stratigraphy, Geomorphology, Quaternary period, Permeability, Aeolian soils, Sinks, Karst.
Identifiers: Coastal plain sedimentation.

Quaternary and Recent aeolian and fluvial sands have a characteristic distribution pattern on watersheds in the Coastal Plain of Georgia. The streams lie on the western side of south-draining valleys, and the maximum aeolian and fluvial sediment thickness (sand dunes) is attained east of the stream and on the west-facing valley flank. These sediments form a highly permeable veneer over the older marine formations. They vary in thickness throughout the watershed with the maximum being 20 to 25 feet, and act as a shallow phreatic aquifer, making groundwater available to deep recharge, return flow to streams, and evapotranspiration. The aeolian and fluvial sediment distribution was controlled by the source effect on the stream runoff, pond and pit site location, drainage systems, soil development, watershed infiltration rates, and stream location. (Knapp-USGS)
W71-05580

SEDIMENT BUDGETS ON A COMPARTMENTED LOW-TO-MODERATE ENERGY COAST IN NORTHWEST FLORIDA,
Florida State Univ., Tallahassee.
F. W. Stapor.
Marine Geology, Vol 10, No 2, P M1-M7, February 1971. 7 p, 3 fig, 4 ref.

Descriptors: *Sediment transport, *Coasts, *Littoral drift, *Surf, Barriers, Sand bars, Bottom sediments, Waves (Water), Currents (Water), Dunes, Sands, Islands.
Identifiers: *Sediment budgets.

Sediment budgets for portions of the Franklin and Gulf County, Florida, coast were determined through comparison of old U.S. Hydrographic Office smooth sheets. Rate of erosion and deposition and minimum distances of transport were computed. This coast is divided into at least six individual compartments (or longshore drift cells) which probably experience minimal communication; in each instance erosion and deposition are nearly balanced. This is a result of the low-to-moderate wave energy and the offshore bathymetry of the region. (Knapp-USGS)
W71-05584

MEASUREMENTS OF INCIPIENT MOTION OF SEDIMENT PARTICLES IN THE MARINE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W71-05585

A COMPUTER SIMULATION MODEL OF SEDIMENTATION IN A SALT WEDGE ESTUARY,
Sheffield Univ. (England). Dept. of Geology.
For primary bibliographic entry see Field 02L.
W71-05586

DIFFUSION COEFFICIENT OF SILICA IN SEAWATER,
Brussels Univ. (Belgium). Industrial Chemistry Lab.; and Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02K.
W71-05595

ARAGONITE INORGANIC PRECIPITATION IN A FRESHWATER LAKE,
Heidelberg Univ. (West Germany). Sediment Research Lab.
German Muller.
Nature Physical Science, Vol 229, No 1, p 18, January 4, 1971. 1 p, 2 ref.

iptors: *Sediments, *Lakes, *Lake soils, ite, Crystallization, Magnesium, Calcium, In- ic compounds, Phytoplankton, Clays, Alluvi- Chemical precipitation, Water chemistry, olytes.
fiers: *Lake Balaton (Hungary), *Aragonite itation, Freshwater lake.

ke Balaton, Hungary, large quantities of fine d, high-magnesian calcite are precipitated the warmer seasons by a strong growth of plankton. The formation of high-magnesian e can be related to the high Mg/Ca ratio of the vater which varies locally between about one nree. The elecyrolyte concentration of the water is less than 500 mg/liter. The high a ratio of the lake water influences both the llization of aragonite and high-magnesian e as is the case under marine and some hyper- conditions. (Woodard-USGS)
05597

OM CURRENTS IN WILMINGTON SUB- NE CANYON,
nors State Univ., Park Forest, Ill.; University of Swansea (Wales). Dept. of Geology; and sonian Institution, Washington, D.C. Sedi- logy Div.
imary bibliographic entry see Field 02L.
05600

EXCHANGE AND RADIOCARBON DAT- OF ALLUVIAL SEDIMENTS FROM THE ER RIO COPIAPO, CHILE,
to de Investigaciones Geologicas, Santiago); Queen's Univ., Kingston (Ontario). Dept. logic Sciences; and New Mexico Highlands Las Vegas. Dept. of Chemistry.
c Mortimer, A. H. Clark, and J. A. Schufle.
e Physical Science, Vol 229, No 2, p 54-55, ry 11, 1971. 2 p, 2 fig, 6 ref.

iptors: *Dating, *Geologic time, *Ion nge, Alluvial channels, Methodology, Test dures, Sampling, Sodium, Potassium, Evalua- Radioactive dating, Carbon radiosotopes, In- entation.
fiers: *Alluvial sediments, *Lower Rio po (Chile).

relation between ion exchange and radiocar- ges for terrace sediments is described. The change method seems to be at its best in en- nents which are geomorphologically well d. In the Lower Rio Copiapo, Chile, channel es of alluvial sediment were collected for ion nge dating from the bluff of the principal ter- on the left bank. After screening, the minus- nesh sediment fractions were analyzed. Ca- were extracted by leaching with a 1 molar on of ammonium acetate in a ratio of 1:10 he soil by weight. The resulting mush was al- to stand for 24 h before being filtered and ed for Na and K by flame photometer. Both d K are seen to attain peak concentrations at th of only 6 cm. The time taken for these ca- to attain concentration peaks at a depth of 6 ere calculated. An approximate age of 1,000 the Rio Copiapo principal terrace is in agree- with the radiocarbon dating. (Woodard-)
05601

IPITATION OF VATERITE IN LAKE ER,
ic Energy Research Establishment, Harwell and).
rimary bibliographic entry see Field 02K.
05603

SEDIMENTARY FRAMEWORK OF ETON BAY, QUEENSLAND,
y Univ. (Australia). Dept. of Geology and hysics.
rimary bibliographic entry see Field 02L.
05615

PLEISTOCENE STRATIGRAPHY OF THE SALISBURY AREA, MARYLAND, AND ITS RELATIONSHIP TO THE LOWER EASTERN SHORE: A SUBSURFACE APPROACH,
Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 02F.
W71-05619

HEAVY MINERALS IN BEACH AND STREAM SEDIMENTS AS INDICATORS OF SHORE PROCESSES BETWEEN MONTEREY AND LOS ANGELES, CALIFORNIA,
Army Coastal Engineering Research Center, Washington, D.C.
Charles W. Judge.
CERC Technical Memorandum No 33, Nov 70. 52 p, 46 ref.

Descriptors: Shore protection, *Littoral drift, *Sands, *Sediment transport, California.
Identifiers: Heavy minerals, Epidote, Augite, Hornblende, Garnet, Zircon, *Littoral transport, *Littoral barrier, Sand analysis, Point Conception (Calif).

A study of heavy minerals on the California Coast was made at CERC as an adjunct to the Radioisotopic Sand Tracer (RIST) and the Littoral Environmental Observation (LEO) programs. Beach samples taken during various times of the year were supplemented by samples from offshore and the rivers. Heavy minerals in the 63-125 micron fraction of the samples were identified by optical techniques. Five provinces were identified: (1) a northern Hornblende province from north of Monterey Bay to Piedras Blancas Point; (2) a northern Augite Province from Piedras Blancas to Avila Beach; (3) an Epidote province from Avila Beach to Ventura; (4) a southern Augite Province from Ventura to Palos Verdes Point; and (5) a southern Hornblende Province from Point Fermin south. The ratios of the less stable augite and hornblende to the more stable garnet and zircon indicated a southward littoral transport north of Point Conception. Increase in grain sizes and in augite and hornblende content south of the input from the Ventura and Santa Clara Rivers indicated a southward net littoral transport there. Similar trends could not be found between Point Conception and Ventura. Because of possible multiple sources for augite and reversals in littoral transport, heavy minerals are not definitive indicators of littoral drift from Point Conception to Ventura. However, considering other evidence from radioisotopic tracer surveys, historical surveys and dredging projects, it is reasonable to conclude that, although Point Conception-Point Arguello may act as a partial barrier, some sand moves south and east around them. (CERC)
W71-05655

TRACING SAND MOVEMENT IN THE LITTORAL ZONE: PROGRESS IN THE RADIOISOTOPIC SAND TRACER (RIST) STUDY - JULY 1968-FEBRUARY 1969,
Army Coastal Engineering Research Center, Washington, D.C.
David B. Duane.
CERC Miscellaneous Paper 4-70, Aug 70. 52 p, 28 ref.

Descriptors: *Sediment transport, *Sediment distribution, *Beaches, Data processing, *Oceanography, Instrumentation.
Identifiers: Dynamic oceanography, Littoral processes, *Sediment tracers, Sediment analyses, *Hydrographic surveys, Radioisotopes, Xenon-133, Gold 198-199, Radiation detector, Cesium iodide crystals, Headlans, California.

Tagging procedures, instrumentation, field surveys and data handling techniques have been developed by the radioisotopic sand tracing study for the collection and analysis of over 12,000 bits of information per hour over a survey track of about 18,000 feet. Data obtained can be considered as nearly synoptic observations of sediment transport in a single environmental zone or in adjacent beach, surf and offshore zones. Experiments at Surf, Point Conception, Point Mugu, and Oceanside, California, used sand tagged with isotopes of xenon or gold. Data from studies in beach areas unmodified by littoral barriers indicate that the alongshore velocity of sediment transport differs from zone to zone. Transport seaward of peaking, breaking waves is less than transport on the beach face which is less than transport in the plunge and surf zone. Zone dimensions change with waves and tides. Tracing surveys confined to the foreshore of offshore zones produce data only partly indicative of transport in the zone of immediate concern to coastal engineers. Studies conducted at the site of shore structures indicate the RIST system can provide data useful in understanding the effect of such structures on sediment transport. (CERC)
W71-05657

RAPLOT II - COMPUTER PROGRAM FOR DATA PROCESSING AND GRAPHICAL DISPLAY FOR RADIOISOTOPIC SAND TRACER STUDY,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05658

EXPERIMENTAL DUNES OF THE TEXAS COAST,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 08A.
W71-05660

GEOMORPHOLOGY AND SEDIMENTS OF THE NEARSHORE CONTINENTAL SHELF MIAMI TO PALM BEACH, FLORIDA,
Army Coastal Engineering Research Center, Washington, D.C.
David B. Duane, and Edward P. Meisburger.
Available from NTIS as AD-699 339, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No 29, Nov 1969, various paging.
Identifiers: *Beaches, Protection, *Continental shelves, Deposits, Sand, Ocean bottom sampling, Sedimentation, Degradation, Seismic waves, Reflection, Seacoast, Echo ranging, Surveying, Florida, *Shore protection, Palm Beach (Fla), Miami (Fla), Boca Ration (Fla), Geomorphology.

The Continental Shelf off SE Florida between Palm Beach and Miami was surveyed to locate and evaluate sand deposits usable for artificial beach nourishment. Survey data covered 141 square miles of that part of the Continental Shelf between 15 and 100-foot depths, and consisted of seismic reflection profiles and sediment cores from the sea floor. As beach nourishment, sand-sized sediments from the shelf off SE Florida are of marginal quality.
W71-05674

2K. Chemical Processes

POLYWATER AND POLYPOLLUTANTS,
Birkbeck Coll., London (England). Dept. of Crystallography.
For primary bibliographic entry see Field 01B.
W71-05346

GEOCHEMICAL HYDROLOGY OF THE GROUNDWATER IN BATON ROUGE, LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
Rashid A. Khan.
Ph. D. Dissertation, Louisiana State University and Agricultural and Mechanical College, January 1971. 104 p, 17 fig, 13 tab, 47 ref, 3 append. OWRR Project A-010-LA (1).

Descriptors: *Water chemistry, *Hydrogeology, *Louisiana, *Aquifer characteristics, Groundwater movement, Aquifers, Saline water, Ion transport, Ion exchange, Chlorides, Bicarbonates, Carbonates, Sulfates, Diagenesis, Membrane processes, Magnesium, Sodium, Potassium, Geochemistry.
Identifiers: *Baton Rouge (La).

Chemical character of the groundwater in the Baton Rouge area of Louisiana is a function of several physicochemical processes, including ion exchange, filtration due to clay compaction, mineral solubility, and mixing of the waters. Chloride water is a mixture of diagenetically altered sea or estuarine water with fresh water. The chloride waters originated from the dilution of original trapped salty water by fresh waters. Sodium bicarbonate water is the result of ion exchange and membrane filtration. Membrane filtration is most active in the area of maximum land surface subsidence. The Ca and Mg bicarbonate waters formed at shallower depths, are principally due to solution of carbonate minerals. Regression analyses suggest that ionic character of the groundwater is not related to the area of supposed recharge, but to the depth of occurrence, the Mississippi River, and extensive withdrawal of water in the industrial area. Hydrochemical facies indicate that Baton Rouge fault acts as a hydrologic barrier. (Knapp-USGS)
W71-05348

SOME METHODS OF APPRAISING THE INTENSITY OF WATER MIGRATION OF CHEMICAL ELEMENTS, (IN RUSSIAN),
Uralskoe Territorialskoe Geologicheskoe Upravlenie (USSR).
G. A. Vostroknutov.
Doklady Akademii nauk BSSR, Vol 14, No 1, p 53-56, 1970.

Descriptors: *Chemicals, *Water properties, *Migration, Precipitation (Atmospheric), Runoff, Oxidation, Weathering, Mathematical studies.
Identifiers: *Hydrochemical balance, Sulfur oxidation, Epigenetic process, Expotentiality law.

Water migration of chemical elements may be subdivided into three mutually interlaced groups: migration from rocks, soils, atmosphere, and biosphere into waters; migration in still and flowing waters; migration from water into water basins and adjacent geospheres. The predominant mode of element migration is established on the basis of hydrochemical balance determined within the limits of a given area and time segment. Studies of the hydrochemical balance in the Ural region revealed a strong influence of oxidation of sulfides on the weathering and migration of ore-containing elements. The results were obtained by integration of several parameters including precipitation, runoff, and concentration of elements. (Wilde-Wisconsin)
W71-05396

DIFFUSIVITY OF OXYGEN IN AQUEOUS ELECTROLYTE SOLUTIONS,
Auburn Univ., Ala. Dept. of Chemistry.
For primary bibliographic entry see Field 01B.
W71-05454

GEOCHEMISTRY OF LAKE MICHIGAN MANGANESE NODULES,
Michigan Univ , Ann Arbor. Great Lakes Research Div
For primary bibliographic entry see Field 02H.
W71-05563

GEOCHEMICAL CHARACTERISTICS OF LAKES MICHIGAN AND SUPERIOR SEDIMENTS,
Michigan Univ , Ann Arbor. Great Lakes Research Div
For primary bibliographic entry see Field 02J.
W71-05570

MONTHLY VARIATION IN PHOSPHATE AND RELATED CHEMICALS FOUND IN THE SEDIMENT IN THE ISLAND AREA OF LAKE ERIE, 1967-68, WITH REFERENCE TO SAMPLES COLLECTED IN 1964, 1965, AND 1966,
John Carroll Univ., Cleveland, Ohio; and Ohio State Univ., Columbus.
For primary bibliographic entry see Field 05A.
W71-05571

A DISCUSSION OF THE CHEMICAL CHARACTER OF WATER MIXTURES,
California Univ., Berkeley. Dept. of Chemistry.
For primary bibliographic entry see Field 05B.
W71-05582

THE DETERMINATION OF LOW LEVELS OF COBALT-60 IN ENVIRONMENTAL WATERS BY LIQUID SCINTILLATION COUNTING,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W71-05590

DIFFUSION COEFFICIENT OF SILICA IN SEAWATER,
Brussels Univ. (Belgium). Industrial Chemistry Lab.; and Scripps Institution of Oceanography, La Jolla, Calif.
Roland Wollast, and Robert M. Garrels.
Nature Physical Science, Vol 229, No 3, p 94, January 18, 1971. 1 p, 4 ref.

Descriptors: *Diffusion, *Silica, *Sea water, Membrane processes, Laboratory tests, Methodology, Test procedures, Sediments, Oceans, Salinity, Water chemistry, Diagenesis, Sediment-water interfaces.
Identifiers: *Silica diffusion coefficient.

The diffusion coefficient of dissolved monomeric silica in seawater of 36.1% salinity has been determined at 25 deg C by the diaphragm cell method. Silica was permitted to diffuse across a porous membrane from stirred seawater of higher silica concentration into otherwise identical seawater of lower silica concentration. Two separate seawater samples were used and five individual determinations of the diffusion coefficients for silica were made on each sample. There was no significant difference between the average diffusion coefficient in the first run and that for the second run. The average deviation for the ten determinations was 2%. Recent marine sediments probably have a directional diffusional porosity of about 30%. Therefore the apparent diffusion coefficient for such systems should be about 0.3 times the value of the silica diffusion coefficient for pure seawater. (Woodard-USGS)
W71-05595

ARAGONITE INORGANIC PRECIPITATION IN A FRESHWATER LAKE,
Heidelberg Univ. (West Germany). Sediment Research Lab.
For primary bibliographic entry see Field 02J.
W71-05597

ANOMALOUS WATER NOT POLYWATER,
Unilever Ltd., Port Sunlight (England). Unilever Research Lab.
For primary bibliographic entry see Field 01B.
W71-05599

ION EXCHANGE AND RADIOCARBON DATING OF ALLUVIAL SEDIMENTS FROM THE LOWER RIO COPIAPO, CHILE,
Instituto de Investigaciones Geologicas, Santiago (Chile); Queen's Univ., Kingston (Ontario). Dept. of Geologic Sciences; and New Mexico Highlands Univ , Las Vegas. Dept. of Chemistry.
For primary bibliographic entry see Field 02J.
W71-05601

MICROWAVE DIELECTRIC MEASUREMI ON ANOMALOUS WATER,
Cold Regions Research and Engineering Hanover, N.H. and Dartmouth Coll., Han N.H. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 01B.
W71-05602

PRECIPITATION OF VATERITE IN L WATER,
Atomic Energy Research Establishment, Ha (England).
D. L. G. Rowlands, and R. K. Webster.
Nature Physical Science, Vol 229, No 5, p February 1971. 1 p, 9 ref.

Descriptors: *Lakes, *Water properties, *Cal carbonate, *Chemical precipitation, Labor tests, Methodology, Electron microscopy, X diffraction, Water chemistry.
Identifiers: *Vaterite precipitation (Lake wate

Vaterite is a microcystalline form of calcium bonate. It is rarely observed in nature, but has been identified in a precipitate formed in Holl Lake, Norfolk (England). The lake is nearly mile long, is fed by springs at the south end discharges over a weir towards the sea at the n At the south end a narrow stretch, about 200 long, is separated from the main body of the la a low dam which maintains a slightly higher level. In spring 1970, the water at the south developed a marked milky opalescent appear Biological investigations showed no unusual cies at either end of the lake, and no eviden pollution. Chemical and structural ana identified the suspended material as chiefly um carbonate. The chief point of interest i crystal form of the precipitate. Suspended ma separated in the laboratory by 'Millipore' filtr of lake water samples, was examined by ele microscopy; crystals were identified by ele diffraction as vaterite. This was confirmed by X diffraction measurements. (Woodard-USGS)
W71-05603

STABILITY OF MONTMORILLONITES BELLE FOURCHE AND CLAY SPUR MO MORILLONITES,
Washington State Univ., Pullman. Dept. of Science.
For primary bibliographic entry see Field 02G.
W71-05605

LOW-TEMPERATURE PHASES OF INTER CIAL WATER IN CLAY-WATER SYSTEMS
Cold Regions Research and Engineering Hanover, N.H.
For primary bibliographic entry see Field 02G.
W71-05607

MICROCOLUMN CHROMATOGRAP CLEANUP FOR THE ANALYSIS OF PE CIDES IN WATER,
Geological Survey, Menlo Park, Calif. W Resources Div.
For primary bibliographic entry see Field 05A.
W71-05614

SALT EFFECTS IN AQUEOUS SOLUTIONS UREA,
Richard E. Lindstrom, and Alexander R. Giaquinto.
Journal of Pharmaceutical Sciences, Vol 59 11, p 1625-1630, 1970. 6 p, 4 fig, 3 tab, 11 OWRR Project A-024-CONN (1).

Descriptors: *Urea, *Aqueous solutions, *Ch cal reactions, *Salts, Acidity, Alkalinity, E trolytes, Ionization, Methodology, Test proced Model studies, Solubility, Chemical proper Spectrophotometry, Chemical analysis, Soc chloride.
Identifiers: Methyl salicylate solubility, Benz solubility.

ıggested, when working with drug-urea-water
ns, that more than passing consideration be
to the effect or effects produced by addition
ourth component, as, for example, when an
s used to adjust pH. Data are cited which in-
that these effects are measurable and often
ctable. Solubility data for methyl salicylate
ethyl benzoate are given as functions of vary-
id, salt, and urea concentrations. These data
sent the equilibrium solubilities of the esters
various systems at 30 degrees. The solubili-
ere obtained by sampling and subsequent
nination of the ester concentration using UV
ophotometry. A mathematical model was
d which permits a quantitative evaluation of
fects in urea solutions. The theoretical calcu-
s, based on this model, were found to be in
agreement with the experimental values ob-
l for neutral and pH 1 solutions of methyl sal-
e and methyl benzoate in urea. Extension of
findings to an earlier investigation indicates
gnificant error in interpretation of solubility
a may result if these salt effects are disre-
d. (Woodard-USGS)
05618

NE HYDROCHEMISTRY,
imary bibliographic entry see Field 02L.
05666

YSIS OF TIME-VARIANT BEHAVIOR OF ER CHEMISTRY,
la Univ., Reno. Center for Water Resources
rch.
V. A. Sharp.
ican Geophysical Union, 51st Annual Meet-
reprint No 71, Paper H-23. April 21, 1970. 10
ig. OWRR Project A-017-NEV (3) and A-
EV (3).

iptors: *Analytical techniques, *Water
stry, *Time series analysis, *Variability,
l studies, Mathematical models, Water quali-
sting, Hydrology, Water management (Ap-
, Equations, Hydrologic data, Stochastic
sses, Water analysis, Rivers, Cycles, Time,
la, Sampling.
fiers: *Truckee River, *Cyclical behavior,
d behavior, *Constant behavior, *Oscillatory
ior.

variant behavior can be modeled as a discon-
s time-series, composed of time-systematic
tochastic components. The stochastic com-
t is a residual of random fluctuations and
ing. The four model behavior types recog-
are constant, trend, cyclical, and oscillatory.
s illustrate and generating functions are
for each behavior. Sometimes visual observa-
lone may suffice to classify the type of time-
t behavior, but in questionable cases, one or
specific tests must be used to determine
type of behavior has been generated from
nstant parent behavior. Serial correlation
coefficients r sub k, the rank correlation tau
for confirming trends and establishing
ion, the turning points test for fluctuation
ncy, and the runs test used to detect values
or below median values, are all used to
nine into which of the four categories a time-
t behavior series may fall. Examples of the
s behaviors using actual measurements on
uckee River and a well in Nevada are given
xplanatory graphs. The behaviors are illus-
and defined by use of equations. (Yensen-
na)
05705

VERY, SEPARATION, AND IDENTIFICA- OF PHENOLIC COMPOUNDS FROM UTED WATERS,
rs - The State Univ., New Brunswick, N. J.
of Environmental Sciences.
imary bibliographic entry see Field 05A.
05768

2L. Estuaries

ORIGIN OF CLAY MINERALS IN A MID-ATLANTIC RIDGE SEDIMENT,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
For primary bibliographic entry see Field 02J.
W71-05347

MODELING OF THE NITROGEN AND ALGAL CYCLES IN ESTUARIES,
Manhattan Coll., Bronx, N.Y. Environmental Engineering and Science Program.
R. V. Thomann, D. J. O'Connor, and D. M. Ditoro.
Proceedings, 5th International Water Pollution Research Conference, Paper III-9, July-August 1970. 14 p, 9 fig, 1 tab, 10 ref.

Descriptors: *Mathematical models, *Nitrogen cycle, *Oxidation, Ammonia, Nitrites, Oxygen, Phytoplankton, Biochemical oxygen demand, Dissolved oxygen, Estuaries, Water pollution effects, Water pollution sources, Nitrification, Algae.
Identifiers: Algal cycle, Delaware Estuary (Del-NJ), San Joaquin Delta (Calif), Steady-state models.

Two mathematical models were constructed to address the problems of nitrogen and algal cycles. The steady-state, multi-demensional model was used for analyzing nitrification and algal utilization of available nitrogen. The dynamic model incorporated the growth and death of phytoplankton and herbivorous zooplankton and the utilization of inorganic nitrogen. Application of the first model to the Delaware Estuary indicated the rate of ammonia oxidation of about 0.1/day at 20C with nitrification inhibition at DO less than 1-2 mg/l. A lower DO resulted from nitrogen oxidation. The same model applied to the Potomac Estuary indicated algal utilization of nitrates at 0.1/day at 20C. The dynamic non-linear model, applied to Sacramento-San Joaquin Delta, (Calif) adequately described the algal growth and utilization of nutrients. The net algal growth coefficient ranged up to 0.3/day during the spring. (Wild-Wisconsin)
W71-05390

SOME EFFECTS OF TEMPERATURE ON SURVIVAL AND METABOLISM OF SELECTED ESTUARINE BIVALVES,
Rhode Island Univ., Kingston. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-05406

A TECHNICAL ASSESSMENT OF CURRENT WATER QUALITY CONDITIONS AND FACTORS AFFECTING WATER QUALITY IN THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05407

SANITARY BACTERIOLOGY OF THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05C.
W71-05408

WATER QUALITY AND WASTE WATER LOADINGS UPPER POTOMAC ESTUARY DURING 1969,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05409

POTOMAC-PISCATAWAY DYE RELEASES AND WASTE WATER ASSIMILATION STUDIES,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05410

UPPER POTOMAC RIVER BASIN WATER QUALITY ASSESSMENT,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05411

FRESHWATER VERTEBRATE AND INVERTEBRATE ECOLOGY OF AMCHITKA ISLAND,
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 02E.
W71-05461

WATER RESOURCES POTENTIAL OF AN URBAN ESTUARY (SAUGUS RIVER, PINES RIVER AND LYNN HARBOR COMPLEX),
Northeastern Univ., Boston, Mass. Dept. of Civil Engineering; and Northeastern Univ., Boston, Mass. Dept. of Environmental Science.
For primary bibliographic entry see Field 05C.
W71-05553

BIOLOGICAL AND CHEMICAL STUDY OF VIRGINIA'S ESTUARIES,
Virginia Inst. of Marine Science, Gloucester Point.
Morris L. Brehmer.
In: Virginia Polytechnic Institute and State University Water Resources Research Center Bulletin 40, p 121-125, December 1970. 5 p. OWRR Project B-003-VA.

Descriptors: *Estuaries, *Virginia, *Water quality, *Reviews, Surveys, Dissolved oxygen, Salinity, Nutrients, Eutrophication, Ecology, Saline water intrusion.
Identifiers: Chesapeake Bay.

Virginia's estuaries are dynamic systems characterized by high levels of instability. The reaches near Chesapeake Bay are the most stable since they are least affected by variations in freshwater inflow from the tidal river. The middle reach encompasses the gradient zone in which the water may be completely fresh during extremely high discharge periods and approach 50% seawater during drought conditions. The location of the transition zone between fresh and salt water also shifts with discharge levels and may vary as much as 20 miles upstream and downstream from the 'average' point within a season. Dissolved oxygen levels in Virginia's three major estuarine systems did not approach extremely low values during the study period. (See also W71-05555) (Knapp-USGS)
W71-05558

DEPOSITIONAL PROCESSES AND PRODUCTS IN THE DELTAIC ENVIRONMENT,
Louisiana State Univ., Baton Rouge.
James P. Morgan.
In: Deltaic Sedimentation, Modern and Ancient, Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 31-47, November 1970. 17 p, 13 fig, 2 tab, 34 ref.

Descriptors: *Deltas, *Sedimentation, *Sedimentary structures, Mississippi River, Deposition (Sediments), Sediment transport, Bed load, Suspended load, Paleohydrology, Sedimentology, Stratigraphy, Reviews.
Identifiers: *Mississippi Delta, *Ganges-Brahmaputra Delta, *Mekong Delta.

Factors controlling depositional processes and products are analyzed for three of the world's major river-delta systems; the Mississippi, Ganges-Brahmaputra, and Mekong. These three river

systems have deltas with varied geomorphic form which reflects differences in depositional processes. Four basic factors control and influence delta formation: (1) river regime; (2) coastal processes; (3) structural behavior and the relation of sea level to the depositional site; and (4) climatic factors, particularly those that affect vegetation within the delta. The Mississippi delta area is characterized by rapid subsidence, primarily through sediment compaction, and its deposits are subject only to minor modification by coastal processes. The Ganges-Brahmaputra delta is also tectonically controlled but by Quaternary faulting as well as by subsidence through sediment compaction. The Mekong has created a single delta system which has prograded across an essentially rigid platform. Contemporaneously, coastal processes (tides, waves, and currents) have reworked the delta front, creating sand beaches which merge laterally to form widespread sheet sands in the deltaic plain. (Knapp-USGS)
W71-05572

STRATIGRAPHY AND HISTORY OF THE HOLOCENE SEDIMENTS IN THE SABINE-HIGH ISLAND AREA, GULF OF MEXICO,
Mobil Research and Development Corp., Dallas, Tex. Field Research Lab.
Henry F. Nelson, and Ellis E. Bray.
In: Deltaic Sedimentation, Modern and Ancient, Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 48-77, November 1970. 30 p, 13 fig, 5 plate, 2 tab, 36 ref, append.

Descriptors: *Deltas, *Gulf of Mexico, *Sedimentation, *Sedimentary structures, Deposition (Sediments), Sediment transport, Bed load, Suspended load, Paleohydrology, Sedimentology, Stratigraphy, Coastal plains.
Identifiers: *Sabine River (La), *Calcasieu River (La).

The Holocene sediments on the northwest shelf of the Gulf of Mexico were formed in interdeltaic as well as deltaic areas during the postglacial rise of the sea and during its stillstand since it reached its present level. In an interdeltaic area of relatively minor sedimentation off the Texas coast, the Sabine-High Island area, 11 lithotypes were defined during a three-dimensional study of the Holocene sediments. With the exception of one type, peat, all are made up of various combinations of three major sediment components, clay, quartz sand, and shells. These sediments were deposited as five lithofacies on an eroded Pleistocene surface that was crossed by a major topographic feature, the channel of the Sabine and Calcasieu Rivers. The three most important factors controlling the distribution of sediments are topography, variations in the rate of rise of the sea, and currents. (Knapp-USGS)
W71-05573

THE MISSISSIPPI DELTA COMPLEX,
Esso Production Research Co., Houston, Tex.
H. R. Gould.
In: Deltaic Sedimentation, Modern and Ancient, Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 3-30 November 1970. 28 p, 25 fig, 1 tab, 14 ref.

Descriptors: *Deltas, *Mississippi River, *Sedimentation, *Sedimentary structures, Deposition (Sediments), Sediment transport, Bed load, Suspended load, Paleohydrology, Sedimentology, Stratigraphy, Reviews.
Identifiers: *Mississippi Delta.

The Mississippi delta complex is one of the largest and probably best known of the world's major delta systems. Its subaerial surface, the Mississippi deltaic plain, extends from an apex at the mouth of the Mississippi alluvial valley to a base of 200 miles along the Louisiana coast. Underlying this plain and the adjacent continental shelf and slope is a huge mass of late Quaternary river mouth deposits which makes up the deltaic complex. These sediments occupy a seaward deepening troughlike depression in the underlying surface that developed contemporaneously with deposition and which is localized to the depositional area. Downwarping of this segment of the continental margin, together with the eustatic rise in sea level during late Quaternary time, was sufficient to accommodate the great thickness of deposits which reaches a known maximum of about 1,000 feet underlying the continental shelf at the seaward limit of control. Both the shallow-water deltas and the active deep-water birdfoot delta are characterized by distinctive facies which are readily recognized by their lithologic, faunal, and geometric features. (Knapp-USGS)
W71-05574

HOLOCENE GUADALUPE DELTA OF TEXAS GULF COAST,
West Virginia Univ., Morgantown, and Campbell Coll. Buies Creek, N.C., and Esso Standard Libya, Inc., Tripoli.
Alan C. Donaldson, Richard H. Martin, and William H. Kanes.
In: Deltaic Sedimentation, Modern and Ancient, Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 107-137, November 1970. 31 p, 18 fig, 4 tab, 35 ref, 1 plate.

Descriptors: *Deltas, *Sedimentation, *Texas, *Gulf of Mexico, *Sedimentary structures, Deposition (Sediments), Sediment transport, Bed load, Suspended load, Sedimentology, Stratigraphy, Coastal Plains.
Identifiers: *Guadalupe River Delta (Tex).

The Holocene delta of the Guadalupe River is slowly prograding into San Antonio Bay of the Texas Gulf Coast. The delta is part of a modern complex of lagoonal and deltaic sediments deposited along a shoreline dominated by barrier islands. The river deposits its load in a shallow, relatively quiet body of water, and as the delta progrades into increasingly shallow water, distributary channels have become deeper than the present bay floor. Sediments are clay and silty clay except for the basal part of the distributary-channel and delta-front deposits, which are fine-grained sand, silty sand, or silt. Where the delta is birdfoot, the delta-front deposits are shoestring (bar-finger) sands. The overall configuration of the Guadalupe delta is birdfoot. Characteristics which make the Guadalupe delta a distinctive model are: (1) the river discharge and load overwhelm the weaker currents and waves of the bay, (2) deposition is in such a shallow body of water that waves can rework the bay sediments, (3) the river channels are deeper than the present bay floor, (4) the bay is becoming progressively shallower as the delta progrades, and (5) growth is by development of successive subdeltas, most of which are presently deteriorating. (Knapp-USGS)
W71-05575

TRANSPORT OF TRACE METALS TO THE ATLANTIC OCEAN BY THREE SOUTHEASTERN RIVERS,
Skidaway Inst. of Oceanography, Savannah, Ga; and Georgia Inst. of Tech. Atlanta.
For primary bibliographic entry see Field 05B.
W71-05579

SEDIMENT BUDGETS ON A COMPARTMENTED LOW-TO-MODERATE ENERGY COAST IN NORTHWEST FLORIDA,
Florida State Univ., Tallahassee.
For primary bibliographic entry see Field 02J.
W71-05584

MEASUREMENTS OF INCIPIENT MOTION OF SEDIMENT PARTICLES IN THE MARINE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Oceanography.
Richard W. Sternberg.
Marine Geology, Vol 10, No 2, p 113-119, Fe
ry 1971. 7 p, 3 fig, 1 tab, 16 ref. Contract AT
1)-1752 USAEC Grant GA 11149 NSF.

Descriptors: *Sediment transport, *Bottom
ments, *Tides, *Bed load, *Currents (W
Tidal effects, Velocity, Fluid friction, Hydra
Channel morphology, Erosion, Particle size, D
ty, Boundary layers.
Identifiers: Puget Sound (Wash).

During the past few years a series of measure
has been made of flow conditions and assoc
sediment motion occurring in several high-ve
tidal channels in Puget Sound, Washington.
surements consist of the velocity distributio
curring within 2 m of the bed, visual observati
the occurrence of incipient grain movement
time-lapse photography of the seabed. From
data estimates have been made of the mean b
velocity, shear velocity, and Shield's friction c
cient associated with the sediment movemen
mean grain sizes ranging from 0.30 mm to 1.1
and a variety of bed configurations, the c
values of velocity and friction required to in
general sediment motion agree with experime
derived competency curves. The bed-load
port of sediment corresponding to the occur
of general sediment motion for grain sizes ap
mately 0.40 mm in diameter is estimated
0.0084 gm per cm per sec. This movement
sociated with mean velocity and shear veloc
38.5 and 2.30 cm per sec, respectively. (K
USGS)
W71-05585

A COMPUTER SIMULATION MODEL SEDIMENTATION IN A SALT WEDGE ES RY,
Sheffield Univ. (England). Dept. of Geology.
D. G. Farmer.
Marine Geology, Vol 10, No 2, p 133-143, Fe
ry 1971. 11 p, 4 fig, 28 ref.

Descriptors: *Simulation analysis, *Mathem
models, *Computer programs, *Sediment
*Estuaries, Sediment transport, Deltas, Depo
(Sediments), Saline water intrusion, Stratified
Density stratification.
Identifiers: Sedimentation models, Salt-w
estuaries.

Simulation with a digital computer was appli
the field of estuarine sedimentation. A simul
model of sedimentation in the relatively simpl
wedge' type of estuary was considered in term
section of intrusion of the salt wedge exte
from the mouth, and a fresh water sectio
stream. The model is illustrated by an experi
in which constant input conditions are assu
(Knapp-USGS)
W71-05586

BOTTOM CURRENTS IN WILMINGTON MARINE CANYON,
Governors State Univ., Park Forest, Ill.; Univ
Coll. of Swansea (Wales). Dept. of Geology
Smithsonian Institution, Washington, D.C.
mentology Div.
Peter Fenner, Gilbert Kelling, and Daniel J.
Stanley.
Nature Physical Science, Vol 229, No 2, p 5
January 11, 1971. 3 p, 1 fig, 12 ref.

Descriptors: *Sediment transport, *Bottom
ments, *Continental shelf, *Ocean currents,
lantic Ocean, Ships, Investigations, Methodo
Photography, Flow, Velocity, Current meters,
collections, Evaluation.
Identifiers: *Wilmington Canyon (Atlantic Oc

The data on bottom currents presented here
obtained from near the head of Wilmi
Canyon, which indents the outer margin of the
tinental shelf 140 km southeast of Delaware
Underwater photography of the seafloor in th
gion revealed fresh ripple-marks and other fea

ndicating recent bottom current activity. An underwater television survey during July 1968 obained direct evidence of current activity within the anyon and on the adjacent continental shelf and lope. Current flows, with an estimated maximum elocity of 25 cm s to the minus one, were observed rom the videotapes, moving turbid water just bove the seafloor near the canyon margins. The elocities recorded show that these currents are apable of moving sediment of fine to medium and, and this material is transported across the outermost shelf and trapped in the canyon head. Once n the canyon, bottom sediment is acted on by axial urrents of similar competency but of possible scillatory character, which ultimately produce net own-canyon transport of the sediment. (Woodard-USGS)
W71-05600

THE SEDIMENTARY FRAMEWORK OF MORETON BAY, QUEENSLAND,
ydney Univ. (Australia). Dept. of Geology and Geophysics.
V. G. H. Maxwell.
Australian Journal of Marine and Freshwater Research, Vol 21, No 2, p 71-88, December 1970. p, 11 fig, 17 ref.

Descriptors: *Sedimentation, *Provenance, *Bays, Sand bars, Dunes, Reefs, Sedimentary structures, Stratigraphy, Carbonate rocks, Sands, Deposition (Sediments), Sediment transport.
Identifiers: *Moreton Bay (Queensland), *Australia.

Moreton Bay occupies an area of 540 sq miles on he south-east Queensland (Australia) shelf, and is bordered on the east by high barrier islands. It is livisible into a deep northern sector and a narower southern region with numerous small sand slands. Vigorous tidal activity has resulted in tidal leltas and sand ridges on the northern and eastern nargins. The main sedimentary pattern in the Bay s determined by the Mesozoic and Cainozoic histoy of the region, particularly the tectonic and eustatic variation. At the present time, the main sediment source is from the shelf and barrier islands where ancient dune deposits are feeding the Bay. The main contribution from the western land mass s mud, which is largely restricted to the western part of the Bay. Relict coral reefs and existing coral communities contribute to a carbonate facies which is very restricted in distribution. The main movement of sediment is by tidal currents which are most effective on the eastern side of the Bay where the sediment is predominantly quartz sand. (Knapp-USGS)
W71-05615

MARINE HYDROCHEMISTRY,
. K. Blinov.
Available from NTIS as AD-711 925, $3.00 in paper copy, $0.95 in microfiche. Cold Regions Research and Engineering Lab., Hanover, N.H. Translation, 1970. 76 p. Trans. from Trudy Gos. Okeano. Inst-ta, No 83, 1965.
Identifiers: *Salinity, *Oceanology, *Sea ice, Salinity, Hydrology, Sea water, Concentration (Chemistry), Phase studies, Chlorides, Salts, USSR, Chlorinity, Translations.

The report consists of two chapters of an unfinished book, 'Khimiya Morya' ('Marine Chemistry'). It discusses the salt composition of ocean waters, salinity and the composition of salts in sea ice in relation to processes of phase transitions and formation of ice from sea water as a complex solution.
W71-05666

BACKGROUND PAPERS ON COASTAL WASTES MANAGEMENT.
National Academy of Sciences-National Research Council, Washington, D.C. Committee of Oceanography; and National Academy of Engineering, Washington, D.C. Committee on Ocean Engineering.
For primary bibliographic entry see Field 05B.
W71-05787

NEW YORK CITY - A MAJOR SOURCE OF MARINE SEDIMENT,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 05B.
W71-05790

PHYSICAL PROCESSES IN COASTAL AREAS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 05B.
W71-05792

PHYSICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 05B.
W71-05793

SOME CHEMICAL AND GEOCHEMICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W71-05798

BIOLOGICAL EFFECTS OF WASTE DISCHARGES ON COASTAL RECEIVING WATERS,
Engineering-Science, Inc, Forest Hills, N.Y.; and Engineering-Science, Inc., Arcadia, Calif.
For primary bibliographic entry see Field 05C.
W71-05799

BIOLOGICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 05B.
W71-05801

THE COASTAL POLLUTION PROBLEM IN CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05B.
W71-05802

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

METHODOLOGICAL ASPECTS OF TECHNICO-ECONOMIC PARAMETERS OF NUCLEAR DESALINATION PLANTS,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
Yu I. Koryakin, A. A. Loginov, and V. A. Chernyaev.
Desalination, Vol 7, p 323-342, 1970. 3 fig, 6 ref.

Descriptors: *Desalination plants, *Financial analysis, *Nuclear powerplants, *Cost analysis, Economics, Methodology, Technology, Thermal power, Heat, Distillation, Cost comparisons.
Identifiers: *Power and water production, Ginter triangle.

Technical and economic parameters of nuclear desalination plants are outlined. The suggested methodology is based on the category of 'evaluated expenditure,' widely used in the USSR in different sectors of national economy. The analysis of existing methods of appraisal of costs of a plant producing electricity and heat permitted a formulation of a generalized method. The latter eliminates shortcomings of other approaches and is considered to be the most advantageous; it presents a correct distribution of costs of the nuclear total expenditure of a power station. (Wilde-Wisconsin)
W71-05404

DESALINATION - A SURVEY OF AUSTRALIAN PLANTS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Chemical Engineering; and Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
L. S. Herbert, and D. H. Moffatt.
Australian Water Resources Council Research Project No 68/6, 1970. 142 p, 8 fig, 15 plate, 2 tab.

Descriptors: *Desalination, *Reviews, *Arid lands, *Water costs, Distillation, Reverse osmosis, Electrodialysis, Ion exchange, Water quality, Water treatment.
Identifiers: *Australia, *Desalination (Australia).

Detailed information was obtained on costs and aspects of operation during visits to 12 desalination plants in Australia. Existing, proposed and formerly operating plants are listed. A summary is given of the main design, operational and cost data relating to the 8 plants surveyed for which detailed information was available. Some plants are being used below their design capacity because the water is not required during some part of the year, while others do not achieve design capacity because of operational difficulties in heat supply, excessive downtime for scale removal, major mechanical problems, etc. Of the plants surveyed, larger plants appear to operate more satisfactorily than smaller plants. Those plants designed for, and operating on weakly saline waters, presented fewer problems in operation than plants designed for, and operating on sea water. (Knapp-USGS)
W71-05613

3B. Water Yield Improvement

INTERPRETATION OF ELECTRIC AND GAMMA RAY LOGS IN WATER WELLS,
Gearhart-Owen Industries, Inc., Fort Worth, Tex.
For primary bibliographic entry see Field 04B.
W71-05688

A STUDY OF THE MECHANISMS AND SUPPRESSION OF EVAPORATION OF WATER FROM SOILS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 02D.
W71-05717

COMMUNITY WATER SUPPLY IN DEVELOPING COUNTRIES: A QUARTER-CENTURY OF UNITED STATES ASSISTANCE,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Frederick E. McJunkin.
Department of State Agency for International Development, Washington, DC, 1969. 86 p. Supported by Office of International Health, United States Public Health Service.

Descriptors: *Water supply, *Foreign countries, *Federal government, *Sanitation, Reviews, *Training, *Foreign research, Regions, *Geographical regions, *Public health, *Economic impact, Social impact.
Identifiers: *Foreign aid, Brazil, East Pakistan, Thailand, Yemen.

The history and status of United States technical and capital assistance (a billion dollars since 1942) for water supply in developing countries are reviewed by region and country, including its context as part of foreign aid generally and its growth from early days (1942) in Latin America to a global program and an important element of multilateral programs. The essential role of water supply in developing countries (why foreign aid for water supply) is reviewed with particular attention to health (500 million water-related illnesses annually), economic development, nutrition, population control, and political and social development. Current deficiencies and needs are outlined by region. Six projects from the hundreds undertaken are highlighted as examples of educational assistance (Regional School of Sanitary Engineering for Central America), development and strengthening of a national water supply program (Brazil), institution-building (Department of Public Health Engineering in East Pakistan), technological development (new handpump for wells), capital assistance (John F. Kennedy Memorial Water System in Yemen), and rural water supply (Thailand). Lessons and observations based on a quarter-century of experience include: (1) community water supplies in developing countries are still generally inadequate despite recent progress; (2) community water supplies are essential investments for community development and sustained economic growth, they encourage progressive forces, emphasize human progress, and stimulate self-help concepts; (3) a self-liquidating water supply system is a feasible goal for urban communities of even the poorest countries; (4) well-conceived, well-engineered water supply projects can attract international financing; (5) preventive health programs that ignore water supply are invariably failures; (6) deficiencies in personnel and in institutions are currently the critical factors in development of community water supplies, not technology and probably not capital--a realistic program for improvement will require attention to institution building and personnel training; (7) the major accomplishment of the Community Water Supply Program is not hardware but the progress to date in establishment or strengthening of water supply institutions; however technical assistance must be continued until these have ripened to full maturity.
W71-05821

3C. Use of Water of Impaired Quality

HYDROLOGICAL PROBLEMS RELATED TO THE USE OF SALINE WATERS,
Council of Scientific and Industrial Research, New Delhi (India).
S. Banerji.
Nature and Resources, Vol V, No 2, p 13-15, June 1969.

Descriptors: *Saline water, *Water utilization, *Water resources development, *Water quality, *Planning, United Nations, Foreign countries, Research and development, Salinity, Water types, Hydrologic aspects, Sea water, Surface waters, Subsurface waters, Aquifers, Fresh water, Reclamation, Water policy.

A panel of experts from various United Nations agencies met to discuss problems related to use of saline waters. The panel identified types of hydrological processes producing water salinity of surface and subsurface waters in both inland and coastal or marine areas. Categories of water salinity were established, rating waters as fresh, mineralized, slightly saline, moderately saline, saline, oceanic, and briny according to proportions of total dissolved salts present. Uses of saline water having a hydrological impact were agriculture and fisheries, urban and rural water supplies, industrial use, navigation, and demineralization. The panel drafted questionnaires to be sent to countries using saline water to elicit more information on the use of saline waters and the handling of related problems. Effects produced by upstream development of rivers and use of fresh waters were listed, including effects of irrigation, changing land use, evapotranspiration, over-extraction of groundwater, reclamation of coastal areas, sea-water intrusion, decreased river flow, improvement of navigational facilities and development of oil fields. The panel will prepare a bibliography of works dealing with saline water, make an inventory of saline waters potentially available for use, prepare maps of such waters, and disseminate all findings of the panel. (Yensen-Arizona)
W71-05465

GROWTH OF ATRIPLEX HALIMUS L. IN SODIUM CHLORIDE SALINATED CULTURE SOLUTIONS AS AFFECTED BY THE RELATIVE HUMIDITY OF THE AIR,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
For primary bibliographic entry see Field 02I.
W71-05714

3D. Conservation in Domestic and Municipal Use

FUTURE WATER DEMANDS - THE IMPACTS OF TECHNOLOGICAL CHANGE, PUBLIC POLICIES, AND CHANGING MARKET CONDITIONS ON THE WATER USE PATTERNS OF SELECTED SECTORS OF THE UNITED STATES ECONOMY: 1970-1990,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06D.
W71-05339

3E. Conservation in Industry

FUTURE WATER DEMANDS - THE IMPACTS OF TECHNOLOGICAL CHANGE, PUBLIC POLICIES, AND CHANGING MARKET CONDITIONS ON THE WATER USE PATTERNS OF SELECTED SECTORS OF THE UNITED STATES ECONOMY: 1970-1990,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06D.
W71-05339

EFFECT OF WATER RESOURCES ON ECONOMIC GROWTH IN THE TENNESSEE VALLEY REGION,
Tennessee Univ., Knoxville. Coll. of Business Administration.
For primary bibliographic entry see Field 06D.
W71-05382

3F. Conservation in Agriculture

FUTURE WATER DEMANDS - THE IMPACTS OF TECHNOLOGICAL CHANGE, PUBLIC POLICIES, AND CHANGING MARKET CONDITIONS ON THE WATER USE PATTERNS OF SELECTED SECTORS OF THE UNITED STATES ECONOMY: 1970-1990,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06D.
W71-05339

MANAGEMENT OF AGRICULTURAL RESOURCES TO MINIMIZE POLLUTION OF NATURAL WATERS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05G.
W71-05341

CONTROL OF WATER POLLUTION FROM SOUTHWESTERN CATTLE FEEDLOTS,
Texas Tech Univ., Lubbock. Water Resources Research Center.
For primary bibliographic entry see Field 05D.
W71-05412

EQUIPMENT FOR DISPOSAL OF AGRICULTURAL EFFLUENTS,
National Agricultural Advisory Service, London (England).
For primary bibliographic entry see Field 05D.
W71-05413

FERTILIZATION OF ANNUAL RANGELAND WITH CHICKEN MANURE,
California Univ., Riverside. Dept. of Agronomy.
For primary bibliographic entry see Field 05D.
W71-05419

AGRICULTURAL PRACTICES AND WATER QUALITY.
For primary bibliographic entry see Field 05B.
W71-05437

POTENTIAL USEFULNESS OF ANTITRANSPIRANTS FOR INCREASING WATER USE EFFICIENCY IN PLANTS,
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 02I.
W71-05443

THE EFFECT OF ANTITRANSPIRANT MATERIALS ON THE RADIATION BALANCE AND EVAPORTANSPIRATION IN AN IRRIGATED ALFALFA FIELD, ADDENDUM TO FINAL REPORT,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
For primary bibliographic entry see Field 02D.
W71-05453

PRODUCTION, CRUDE PROTEIN, AND USE OF 11 IRRIGATED GRASSES AND ALFALFA-GRASS COMBINATIONS ON CLAY SOILS IN WESTERN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Range Management.
James R. Johnson, and James T. Nichols.
South Dakota Agricultural Experiment Station, Bulletin 555, April 1969. 15 p, 7 tab, 3 fig, 22 ref.

Descriptors: *Crop production, *Crop response, *Proteins, *Grasses, *Fertilization, Soil-water-plant relationships, Cutting management, Alfalfa, Fertility, Nitrogen, Growth rates, Persistence, Economic prediction, Grazing, Wheatgrasses, Range management, Watershed management, Seasonal, Clays, South Dakota, Great Plains.
Identifiers: *Irrigated grasses, Semiarid lands.

To determine regional suitability based on production, crude protein percentage, season of growth, and persistence under irrigation, 11 grasses were grown on clay soils in 3 ways: (1) without supplemental fertility; (2) with 100 pounds of nitrogen per acre annually; and (3) in association with alfalfa. Data were collected for 4 seasons. Average fertilized grass yield of 6,205 pounds per acre. Grass from the alfalfa-grass combinations almost equaled non-fertilized grass production. Alfalfa-grass combination provided the best production distribution for multiple cuttings or growing season grazing. Fertilized grass gave the largest single forage cutting. Non-fertilized grass could not economically compete with other irrigated crops. Nitrogen treatment enhanced protein percentage. Earliest grazing could be made by crested wheatgrass, followed by other wheatgrasses. This information is useful for optimal range and watershed management in the Northern Great Plains. (Popkin-Arizona)
W71-05464

SELECTED CHARACTERISTICS OF REPRESENTATIVE IRRIGATED AND DRY-LAND FARMS AND RANCHES IN THE BELLE FOURCHE AREA,
Economic Research Service, Brookings, S. Dak.
Charles C. Micheel.

nded in part by the U.S. Department of Agricul-
re, Economic Research Service, Farm Produc-
n Economics Division. South Dakota Agricul-
ral Experiment Station, Bulletin 556, May 1969.
p, 24 tab, 2 fig, 5 ref.

escriptors: *Irrigated land, *Dry farming,
)perating costs, *Irrigation programs, *Compara-
e productivity, Livestock, Value, Employment,
ices, Hay, Oats, Barley, Corn (Field), Farm
anagement, South Dakota.
entifiers: Belle Fourche Irrigation Project,
miarid lands.

ta for 1963 from farms and ranches on the Belle
urche Irrigation Project and surrounding dry-
ds in northwestern western South Dakota are
d to describe and compare dryland and irrigated
its. Livestock, mainly beef cattle and sheep, are
sed on most units. Net worth of irrigated farms
erage $20,130 on 240-acre units to $35,675 on
0-acre units. Younger operators are on larger
its. One-third of the irrigation operators had
rt-time off-farm jobs earning an average of
,700 per year, and 10% of the wives had year-
und full-time earnings of $3,100. Fewer dryland
erators or wives had off-farm work. Irrigation
erators listed 'lack of rain' as a major problem.
th groups listed 'low prices and high costs' as a
condary problem. About 8% of the hay, 1% of
e barley, 10% of the oats, and 24% of the corn
sed on irrigated units was sold for cash. Dryland
d was not sold for cash. Little interdependence
tween irrigation and dryland operators was
nd, except where operators have some irrigated
pland and some rangeland, as was the case in 6
the 69 sample units studied. Tables summarize
oduction, cost, cultural practices, and size and
tribution of agricultural units. (Popkin-Arizona)
71-05466

USTRALIAN-AMERICAN INTERBASIN ATER TRANSFER,
olorado Univ., Boulder. Dept. of Geography.
r primary bibliographic entry see Field 06D.
71-05477

OSTS FOR GROWING POTATOES UNDER LF-MOVING CIRCULAR SPRINKLERS,
yoming Agricultural Extension Service, Laramie.
uglas E. Agee.
yoming Agricultural Extension Service, Bulletin
2, July 1969. 12 p, 1 fig, 9 tab, 1 ref.

scriptors: *Operating costs, *Crop production,
ficiencies, *Comparative productivity, *Sprin-
r irrigation, Farm management, Fertilization,
eds, Production, Furrow irrigation, Labor,
tatoes, Wyoming.
entifiers: *Circular sprinklers, Semiarid lands.

erviews of 5 potato growers in southeastern
yoming, who produced 62% of the total 1968
reage, were used to obtain physical and financial
ormation for crop production under circular
inklers. Operators used 13 man hours and 3.2
ctor hours to produce an acre of potatoes. Large
ctors and machinery on large fields and
nimum tillage techniques were used. Seeding fer-
zation, and water application rates conformed
h research recommendations. Total production
sts average $227 per acre for an expected 250
ndredweight, which includes $28 for labor, $168
other cash costs, and $31 for noncash items on
expected yield of 250 sacks at 91 cents per sack.
is compares to a 1966-furrow irrigation cost of
22 per acre, or na adjusted 1968 per acre cost of
58. Potato growers who use circular sprinklers in
yoming produce larger acreages than average,
highly efficient in operations, and are skilled in
oduction techniques. Tables show physical and
ancial data of circular sprinkler and furrow ir-
ation. (Popkin-Arizona).
71-05479

WATER REQUIREMENTS OF SUGARCANE UNDER IRRIGATION IN LAJAS VALLEY, PUERTO RICO,
Puerto Rico Univ., Mayaguez. Agricultural Experiment Station.
Roberto Vazquez.
Available from NTIS as PB-197 992, $3.00 in paper copy, $0.95 in microfiche. Puerto Rico University Agricultural Experiment Station Bulletin 224 (WRRI-FR-71-5) July 1970. 36 p, 4 fig, 15 tab, 9 ref. OWRR Project A-005-PR (1).

Descriptors: *Irrigation, *Sugarcane, *Puerto Rico, *Water requirements, Testing, Experimental forms, Methodology, Soil moisture, Fertilizers, Soil treatment, Irrigation efficiency, Rates of applications, Crop response, Crop production, Soil-water-plant relationships.
Identifiers: *Lajas Valley (Puerto Rico).

Field experiments were conducted in Puerto Rico at the Lajas Substation to determine optimum soil moisture conditions necessary to produce maximum sugarcane and sugar yields. Twenty irrigation regimes were tested. Some of the plots were irrigated frequently and others were irrigated less frequently in the active root zone throughout the growing period. Nitrogen fertilizer treatments were tested at the rate of 200 and 300 pounds per acre per crop. Data were taken for a 13-month plant cane and two 12-month ratoons of sugarcane. The plant cane used more water than the ratoon crop. The mean consumptive use per day was 0.160 inch for plant cane and 0.154 inch for ratoon in the frequently irrigated plots throughout the growing period. The average of the combined yields of a plant cane and two ratoons were 73.67 tons of sugarcane and 7.80 tons of sugar per acre in the frequently irrigated plots, and 59.37 tons of sugar cane and 6.40 tons of sugar per acre in the less frequently irrigated plots. There was no significant difference in yields between plots fertilized at rates of 200 and 300 pounds of nitrogen per acre per crop. (Woodard-USGS)
W71-05554

AVAILABLE WATER AS RELATED TO EVAPOTRANSPIRATION RATES AND DEEP DRAINAGE,
Agricultural Research Service, Prosser, Wash.
For primary bibliographic entry see Field 02G.
W71-05606

EFFECT OF TRICKLE IRRIGATION INTERVALS ON DISTRIBUTION AND UTILIZATION OF SOIL MOISTURE IN A VINEYARD,
Hebrew Univ., Jerusalem (Israel). Dept. of Irrigation; and Ministry of Agriculture, Rehovoth (Israel).
For primary bibliographic entry see Field 02G.
W71-05612

NET AND SOLAR RADIATION RELATIONS OVER IRRIGATED FIELD CROPS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-05622

BIBLIOGRAPHY ON COTTON IRRIGATION,
L. F. Abell, and C. J. Brouwer.
International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands, 1970. 41 p.

Descriptors: *Bibliographies, *Cotton, *Irrigation, *Fertilization, *Economics, Abstracts, Crop production, Crop response, Plant growth, Planting management, Consumptive use, Water requirements, Arid lands, Water conservation.
Identifiers: *Irrigated crops.

Approximately 240 works concerned with consumptive use, or irrigation and water requirements of cotton are listed, some with a brief statement of content. Cotton is a major arid-land crop. Only selected literature published in English, French and German, issued for 1955 to 1969 is included. Bibliographies include masters' theses, books, journals, progress reports, and work done at state agricultural experiment stations. The compilation is divided into sections on irrigation and water requirement, interrelation of irrigation and fertilization, economic aspects of irrigation, bibliographies and reviews on irrigation and water requirement, abstracting journals, and abstracts sections in journals containing pertinent literature. (Popkin-Arizona)
W71-05712

TILLAGE SYSTEM EFFECTS ON WATER USE EFFICIENCY,
Virginia Polytechnic Inst., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W71-05720

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

AN ENVIRONMENTAL SURVEY OF THE LOWER CLEARWATER RIVER,
Idaho Univ., Moscow. Water Resources Research Inst.
C. D. Gordon, D. F. Haber, E. L. Michalson, and J. J. Peebles.
Available from NTIS as PB-197 881, $3.00 in paper copy, $0.95 in microfiche. Idaho University Water Resources Research Institute Information Bulletin No 5, September 1970. 42 p, 3 plate, 4 tab, 8 ref. OWRR Project B-014-IDA (4).

Descriptors: *Water level fluctuations, *Wild rivers, *Reservoir operation, *Recreation, *Environment, Scenery, Wildlife, Fishing, Boating, Wild River Act, Aesthetics.
Identifiers: *Reservoir effects.

The operation of Dworshak Dam, located at the mouth of the North Fork of Idaho's Clearwater River, will result in fluctuations of water level and water quality. A study was made to assess the potential environmental effects on the lower Clearwater River. Beaver, mink, muskrat, otter, weasels and racoons utilize the banks of the river. Upland game such as quail, pheasants, and chukars are present in relatively abundant numbers. Fishing effort on the lower Clearwater is primarily for steelhead and smallmouth bass. There are 33 establishments doing business along the 35.9 mile reach of the lower Clearwater River. Approximately 1.82 billion gallons of water are withdrawn annually from Clearwater River or river subsurface flow to supply the municipal and industrial needs of Lewiston and four small villages. There are a number of archaeological sites along the lower Clearwater River. Six such sites considered to be significant are located between Spalding and Ahsahka. The potential effects of fluctuations of river level and water quality on fisheries, recreation, vegetation, wildlife, aesthetics, and commercial and industrial establishments are briefly discussed. (Knapp-USGS)
W71-05336

FLOOD ROUTING THROUGH STORM DRAINS: PART IV - NUMERICAL COMPUTER METHODS OF SOLUTION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-05376

FLOOD FREQUENCY IN ALASKA,
Geological Survey, Anchorage, Alaska.
For primary bibliographic entry see Field 02E.
W71-05378

PUSHBUTTON CONTROL FOR WATER SYSTEMS MANAGEMENT,
EG and G Inc., Las Vegas, Nev. Development Engineering Dept.; and Engineering Consultants, Inc., Denver, Colo.
L. D. Wilder, and Charles D. Busch.
Paper No 1-246. Agricultural Engineering, p 408-409, July 1970. 1 fig.

Descriptors: *Water management (Applied), *Automatic control, Irrigation, Water distribution (Applied), Telemetry, Waver levels, California, Automation, Arizona, Computer programs, Pilot plants, Canals, Reservoirs, Rivers, Streams.
Identifiers: Servomechanisms, Salt River Project (Ariz), Sacramento Control Center (Calif).

The need to control flow throughout large irrigation projects and their watershed sources, sometimes bridging national boundaries, is bringing automation to water management. Automated systems offer integrated unit control when size precludes regulation by conventional methods. This technology will reach the individual farm level as costs drop and application techniques grow. There are many degrees of sophistication in automation; two methods of supervisory control are now in use. In one the operators do the decision-making based on information provided by the supervisory control system. The second method involved decision-making by a central computer; operation is preprogrammed and the operator's main task is to translate to the computer changing orders for water delivery or emergency situations. A technique long used in industrial engineering for over-all system performance is a pilot plant. One program goal was to evaluate the microdigit water level encoder. It can measure water level in canals, rivers, steams, reservoirs or the position of water control gates, displacement to 0.01 foot accuracy, and gives direct digital conversion. (Jones-Wisconsin)
W71-05400

BIG BLUE RIVER BASIN APPENDIX.
Nebraska Soil and Water Conservation Commission, Lincoln.
For primary bibliographic entry see Field 02E.
W71-05451

EFFECT OF WATERSHED CHARACTERISTICS ON THE TIME PARAMETERS OF RUNOFF HYDROGRAPHS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02A.
W71-05452

COMPARISON OF THE RESULTS OF LABORATORY TESTS WITH DATA OBTAINED BY FIELD OBSERVATIONS OF THE PERFORMANCE OF THE DRAINAGE SYSTEM IN THE SOIL MASSIF ON THE LEFT BANK OF THE BRATSK HYDROELECTRIC PLANT,
For primary bibliographic entry see Field 08D.
W71-05456

FARR V LEACH (REMEDY FOR REFUSAL TO CONSTRUCT DIVERSION DITCH ORDERED BY COUNCIL).
For primary bibliographic entry see Field 06E.
W71-05504

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, KEOTA, OKLAHOMA.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 06B.
W71-05664

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, DARDANELLE-RUSSELLVILLE, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 06B.
W71-05665

SOME COMMENTS ON LINEAR DECISION RULES AND CHANCE CONSTRAINTS,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
For primary bibliographic entry see Field 06B.
W71-05675

SENSITIVITY ANALYSIS: A NECESSITY IN WATER PLANNING,
Texas A and M Univ., College Station; Dept. of Industrial Engineering.
For primary bibliographic entry see Field 06A.
W71-05681

OPTIMIZING THE LONG RANGE OPERATION OF THE CALIFORNIA AQUEDUCT BY INCREMENTAL DYNAMIC PROGRAMMING SIMULATION,
California Univ., Berkeley. Operations Research Center.
For primary bibliographic entry see Field 06A.
W71-05682

A COMPARATIVE STUDY OF CRITICAL DROUGHT SIMULATION,
California Univ., Los Angeles. Dept. of Engineering Systems.
For primary bibliographic entry see Field 02E.
W71-05683

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS; REPORT OF FLOOD CONTROL SUBPROJECT,
Idaho University, Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-05703

4B. Groundwater Management

SUMMARY OF GROUNDWATER HYDROLOGICAL DATA IN MICHIGAN FOR 1969,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02F.
W71-05351

MODEL FOR FLOW AUGMENTATION ANALYSIS - AN OVERVIEW,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05G.
W71-05365

GROUNDWATER RESOURCES IN THE EASTERN OSWEGO RIVER BASIN, NEW YORK,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 02F.
W71-05374

GROUNDWATER IN PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02F.
W71-05377

ARTIFICIAL GROUNDWATER RECHARGE, WET WALNUT CREEK, CENTRAL KANSAS,
Geological Survey, Lawrence, Kans.
J. B. Gillespie, D. W. Green, and S. E. Slagle.
Kansas Water Resources Board Progress Report No 2, January 1970. 28 p, 15 fig, 2 tab, 1 ref, 2 append.

Descriptors: *Artificial recharge, *Pit recharge, *Alluvium, *Kansas, Water spreading, On-site tests, Infiltration, Percolation, Alluvial channels, Surface-groundwater relationships, Aquifers.
Identifiers: *Wet Walnut Creek (Kans).

The capability to artificially recharge the alluvial aquifer underlying Wet Walnut Creek valley, central Kansas, was tested at two sites--one an alluvial slope near the edge of the valley and the other a shallow tributary channel with ephemeral flow. Most of the site-development work is finished except the dam for pond 1 at the tributary-channel site. At the alluvial-slope site, after water pumped from wells has been ponded for several days, the infiltration rate is about 0.5 foot per day. The infiltrated water is perched above a zone of silty clay from where it percolates to the aquifer. At the tributary-channel site, the infiltration rates vary with different channel-bottom conditions. (Knapp-USGS)
W71-05379

INTERPRETATION OF ELECTRIC AND GAMMA RAY LOGS IN WATER WELLS,
Gearhart-Owen Industries, Inc., Fort Worth, Tex.
Hubert Guyod.
Well Log Analysts, January-March 1966, p 2-16, 13 fig, 48 ref.

Descriptors: *Logging (Recording), *Water wells, *Electrical well logging, *Radioactive logging, Drilling, Oil industry, Aquifer characteristics, Groundwater, Geochemistry, Water quality.
Identifiers: *Well log interpretation, Clean granular acquifers, Clayey granular aquifers, Fractured aquifers, Complex aquifers, Dense formations, Clay formations, Water salinity estimation, Porosity and permeability estimation, Special log applicability.

A typical inexpensive logging program for water wells consists of a Normal of single-electrode resistivity, the SP and, sometimes, gamma ray measurements. Some of the principles underlying the analysis of these logs are reviewed. The usual logging situations are classified into three groups and simple interpretation procedures are outlined for each. Much useful information is provided by these records, especially when they are supplemented by the bit penetration rate and other data. The logs can solve many common groundwater problems. Those, and the ones that they cannot solve, are reviewed. (Campbell-NWWA)
W71-05688

PUMPING TEST PROCEDURES FOR AQUIFER ANALYSIS,
Michigan Dept. of Public Health, Lansing. Section of Water Supply.
For primary bibliographic entry see Field 02F.
W71-05694

TELEVISION INSPECTION OF A GRAVEL PACK WELL,
Madison Water Utility, Wis.
Zenno A. Gorder.
Journal of the American Water Works Association, Vol 55, No 1, p 31-34, January 1963.

Descriptors: *Water wells, *Municipal wells, Wisconsin.
Identifiers: Closed-circuit television, Gravel pack well, Water well service equipment, Well screen encrustations.

A closed-circuit television system was used to make a visual probe of a problem well for city of LaCrosse, Wisconsin. The resulting diagnosis of condition of well made possible an economic salvaging operation which completely restored well to normal production. It was possible not only to observe ruptured or encrusted areas, but also to estimate degree of efficiency of mechanical brushing or cleaning operations, and whether such procedures had been worthwhile. The city of LaCrosse salvaged a unit well station worth an esti-

nated $27,000.00 at a cost of less than $10,000.00.
Campbell-NWWA)
V71-05695

OIL FIELD TECHNIQUES USEFUL IN WATER WELL DRILLING,
outhern California Water Co., Santa Barbara.
or primary bibliographic entry see Field 08A.
V71-05696

APPLICATION OF ELECTRICAL AND RADIOACTIVE WELL LOGGING TO GROUNDWATER HYDROLOGY,
eological Survey, Washington, D.C.; and Pennsylania State Geological Survey, Harrisburg.
. P. Patten, and G. D. Bennett.
S Geological Survey Water-Supply Paper 1544-, 1963. 60 p, 11 fig, 23 ref.

escriptors: *Logging (Recording), *Water wells, lectrical logging, Radioactive logging, Oil indus-y.
lentifiers: *Resistivity logging, Calibration, orehole effect, Oil industry interpretation prac-ces, Mud-filled borehole, Water-filled borehole, orosity and formation factor, *Spontaneous-otential logging, Quantitative Interpretation, In-raquifer flow, *Lithologic interpretations.

his report discusses in considerable detail several roblems pertaining to the interpretation of electri-l and radioactive well logs in groundwater ydrology. Emphasis has been placed upon situa-ons in which interpretation departs from the prac-ces common in petroleum engineering. Certain terpretive methods of the oil industry are demon-rated to be unsatisfactory for hydrologic pur-oses, and certain other methods, which have not een commonly used in the oil industry are recom-ended for use in groundwater hydrology. For all ethods, an effort has been made to analyze the in-rpretive methods in terms of underlying theory, an understanding of theory is superior to any emorized set of rules or principles in analyzing e data of well logging. (Campbell-NWWA)
71-05697

IL WELL DRILLING TECHNOLOGY,
or primary bibliographic entry see Field 08A.
71-05698

ROUNDWATER HYDROLOGY FOR WATER ELL DRILLING CONTRACTORS,
ent State Univ., Ohio. Dept. of Geology.
or primary bibliographic entry see Field 02F.
71-05699

IBLIOGRAPHY ON COTTON IRRIGATION,
or primary bibliographic entry see Field 03F.
71-05712

C. Effects on Water of Man's Non-Water Activities

PRELIMINARY ANALYSIS OF THE EF-ECTS OF URBANIZATION ON WATER UALITY,
egional Science Research Inst., Philadelphia, Pa.
or primary bibliographic entry see Field 05A.
71-05359

YDROLOGY OF A SMALL RURAL ATERSHED UNDER SURBURBAN DEVELOP-ENT,
utgers - The State Univ., New Brunswick, N. J.
ept. of Agricultural Engineering.
urt Nathan, George H. Nieswand, and Anthony J. ser.

New Jersey Water Resources Research Institute, New Brunswick Termination Report for period 1966 - 1970, October 1970. 5 p. OWRR Project A-009-NJ (4).

Descriptors: *Rainfall-Runoff relationships, *Small watersheds, Basins, Hydrographs, Runoff, Storm runoff, Surface, Time lag, Time of concentration, Unit hydrographs.

A small rural watershed in New Jersey is being studied for changes in hydrological characteristics during suburban development. Two stream gaging stations and two recording precipitation gages have been established in the area. During the phase covered in this report, regression models for the hydrological properties have been derived for the undeveloped basin. A standard unit hydrograph has also been established for this period. Monitoring of water quality has been initiated recently. The study will be continued during and after development.
W71-05770

ACCESS--ITS EFFECT ON AREA GROWTH AND ENVIRONMENTAL QUALITY.
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 06B.
W71-05776

4D. Watershed Protection

AN EXPERIMENT IN FINITE-DIFFERENCE WATERSHED MODELING,
Montana Univ., Boziman. Joint Water Resources Research Center.
For primary bibliographic entry see Field 02A.
W71-05701

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

A PRELIMINARY STUDY OF THE RELATIONSHIPS BETWEEN STREAM WATER QUALITY AND WATERSHED CHARACTERISTICS FOR THE TRUCKEE RIVER,
Nevada Univ., Reno. Center for Water Resources Research.
R. J. Morris, C. M. Skau, and V. Vitale.
Available from NTIS as PB-197 883, $3.00 in paper copy, $0.95 in microfiche. Nevada University Desert Research Institute Report, September 1970. 14 p, 3 fig, 4 tab, 9 ref, append. OWRR Project A-033-NEV (1).

Descriptors: *Water quality, *Surface waters, *Watersheds (Basins), *Nevada, *California, Environmental effects, Chemical analysis, Streamflow, Runoff, Topography, Vegetation, Land use, Nitrogen, Phosphates, Boron, Data collections.
Identifiers: *Truckee River Basin (Calif. and Nev).

Water quality along the Truckee River between Lakes Tahoe and Pyramid in northeast California and northwest Nevada was investigated. The six major sampling sites defined five major watersheds along the Truckee River between the outlet dam at Lake Tahoe and the inlet to Pyramid Lake at Nixon. Each watershed was characterized by: (1) area; (2) percentage area logged from 1959 through 1968; (3) percentage area burned from 1959 through 1968; (4) percentage area covered by paved and dirt roads; (5) soil-type percentage for each of eight types common to the area; and (6) vegetation of land-use percentage for each of twelve kinds found in the entire Truckee Watershed. Results of chemical analyses for nitrate and organic nitrogen, phosphate, and boron are tabulated. The overall levels of nitrogen and phosphate are comparatively low from Tahoe Dam to Boynton Lake (just above the Sewage Treatment Plant at Reno). The levels fluctuate around that separating oligotrophic and eutropic conditions, commonly taken as 0.1 mg/liter for nitrogen and 0.01 mg/liter for phosphate. Boron concentrations ranged from .03 mg/liter below verdi to 3.18 mg/liter at Steamboat above Sewage Treatment Plant. (Woodard-USGS)
W71-05338

GC DETERMINATION OF SOLUTES BY MULTIPLE PHASE EQUILIBRATION,
Chevron Oil Field Research Co., La Habra, Calif.
Clayton McAullife.
Chemical Technology, Vol 1, No 1, p 46-51, January 1971. 6 p, 8 fig, 2 tab, 10 ref.

Descriptors: Water pollution sources, *Oily water, *Chemical analysis, Methodology, Test procedures, Carbon, *Solutes, Solubility, Phase diagrams, Chemical properties, Equations, Solvents, Mixing, Solvent extractions, Equilibrium, *Gas chromatography, Laboratory tests, *Pollutant identification, Analytical techniques, Oil wastes.
Identifiers: *Hydrocarbons, Oil pollution.

Multiple phase equilibration is exemplified by the analysis of hydrocarbons dissolved in water. The associated technique and data manipulation, which are detailed, have implications for a diversity of other applications. These include estimation of distribution coefficients, Henry's law constants, vapor pressure, solubility, and several related thermodynamic parameters. The method is based on the demonstration that analysis of only one phase after two successive phase equilibriums gives all necessary data. Water containing the hydrocarbons dissolved from crude oil was analyzed. The first-equilibration chromatogram shows all the hydrocarbons through eight carbon atoms normally found in crude oils. As predicted, the first equilibration removed over 96% of the alkanes, leaving aromatic hydrocarbons and about 10% of the cycloalkanes. The third equilibration chromatogram shows only aromatic hydrocarbons. (Woodard-USGS)
W71-05344

DETERMINATION OF HYDROCARBONS IN SEAWATER EXTRACTS OF CRUDE OIL AND CRUDE OIL FRACTIONS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05B.
W71-05345

FIELD TESTING OF THE IAEA PORTABLE RADIOISOTOPE SEDIMENT-CONCENTRATION GAUGE,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 07B.
W71-05352

A PRELIMINARY ANALYSIS OF THE EFFECTS OF URBANIZATION ON WATER QUALITY,
Regional Science Research Inst., Philadelphia, Pa.
Tatsuhiko Kawashima, Thomas R. Hammer, and Robert E. Coughlin.
Pennsylvania Regional Science Research Institute Working Paper, March 1970. 44 p, 7 fig, 3 tab, 3 append. FWQA Grant No. 16090 DYX.

Descriptors: *Urbanization, *Water quality, *Pennsylvania, *Hydrologic data, *Chemical analysis, Surface waters, Construction, Excavation, Environmental effects, Water properties, Streams, Water analysis, Water pollution, Data collections, Water chemistry, Statistical methods, Regression analysis, Variability, Correlation analysis.
Identifiers: *Urbanization-water quality relationships, *Philadelphia (Penn), *Urban hydrology.

The hydrologic effects of urbanization were studied in the Philadelphia metropolitan area. Land uses, in combination with topographic and other natural features, affect water quality characteristics, streamflow regimen, and channel morphology. Approximately 80 watersheds, 1 to 6 miles in area were sampled. These watersheds vary in development from completely rural to completely urbanized. The water samples were collected from 58 streams during a two-day period in September 1969, at a time when there had been no rainfall in the region for several weeks. Thus, the samples were taken to represent water quality conditions at base flow. The results obtained in the analyses of variance for the categorization by industrial density versus the categorization by residential density are strikingly different. For the industrial density categorization, the null hypothesis (of equality of mean concentrations for the High, Medium and Low densities) was rejected at the 1% level of significance for 10 of the 21 chemicals, and at the 5% level of significance for four additional chemicals. On the other hand, for the categorization by residential density, the null hypothesis was rejected at the 5% level for only one chemical, Si02. (Woodard-USGS)
W71-05359

DETERMINATION OF ORGANIC- AND CARBONATE-CARBON IN FRESHWATER LAKE SEDIMENTS BY A MICROCOMBUSTION PROCEDURE,
Wisconsin Univ., Madison. Dept. of Soil Science.
J. G. Konrad, G. Chesters, and D. R. Keeney.
Journal of Thermal Analysis, Vol 2, p 199-208, 1970. 5 fig, 2 tab, 13 ref.

Descriptors: *Analytical techniques, *Carbon, *Sediments, Lakes, Differential thermal analysis, Wisconsin, Analysis.
Identifiers: *Microcombustion procedure, Wisconsin lakes.

The total, organic, and carbonate carbon are determined in sediments of freshwater lakes by a new microcombustion procedure. The content of organic carbon is obtained by combustion of the sample at 650C and that of total carbon at 950C; the content of carbonate carbon is calculated as the difference. The method was evaluated by differential thermal analysis of 28 samples of sediments from lakes of Wisconsin. In addition, carbonate minerals including aragonite, calcite, dolomite, and their mixtures were analyzed by both procedures. The differential thermal analysis was adapted to identify dolomite. The described method eliminates the difficulties encountered by wet oxidation methods in analyses of sediments enriched in iron, manganese, sulfur, and carbonates. (Wilde-Wisconsin)
W71-05399

TYPE DISTRIBUTION OF COLIFORM BACTERIA IN THE FECES OF WARM-BLOODED ANIMALS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
E. E. Geldreich, R. H. Bordner, C. B. Huff, H. F. Clark, and P. W. Kabler
Journal Water Pollution Control Federation, Vol 34, No 3, March 1962, p 295-301. 4 tab, 24 ref.

Descriptors: *Coliforms, *Bacteria, *E. coli, *Farm wastes, Domestic wastes, *Temperature, Cattle, Hog, Sheep, Poultry, Membrane filters, Variability, Water pollution, Surface drainage.
Identifiers: Detection, Enumeration, IMViC, BALB, EC broth procedure, MPN test, Biochemical tests, Correlation.

This investigation examined the reactions of 4512 human, 2339 livestock, and 1896 poultry coliform strains isolated from 43 human, 32 livestock, and 28 poultry fecal samples. The EC procedure showed a 96.3 percent positive correlation and the BALB procedure a 95.3 percent correlation with the coliforms from fecal sources. These findings suggest that the presence of EC or BALB positive coliform strains in water or wastes indicate relatively recent fecal pollution. An occasional shift in percent positive correlation of the elevated temperature test for three human samples during a period of one to three years was noted. The biochemical tests comprising the IMViC typing classification are cumbersome and do not present as close a correlation with fecal origins of the coliform group as other procedures. In view of the excellant reliability of either the EC or BALB test for fecal coliform bacteria, and taking into account the saving in time and effort, the elevated temperature procedure seems to be the method of choice. (White-Iowa State)
W71-05415

THE INFLUENCE OF FEED ADDITIVES ON THE BIOCHEMICAL OXYGEN DEMAND ANALYSIS FOR SWINE WASTES,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
John David Ariail.
Master of Science Thesis, 1970. 72 p, 12 fig, 44 ref. OWRR Project A-048-NC (1).

Descriptors: *Farm wastes, *Hogs, *Lagoons, *Biochemical oxygen demand, Chemical oxygen demand, Water properties, Copper, Zinc, Wastes, Lagoons, Manure, Waste water treatment, Waste identification.
Identifiers: *Swine wastes, Swine feces, Chlorotetracycline, Fecal streptococcus.

The influence of feed antibiotic, chlorotetracycline, copper and zinc concentrations and sample dilution upon the standard 5-day biochemical oxygen demand (BOD5) analysis was investigated with swine feces, lagoon influent and lagoon effluent. The swine-growing center utilized for sample collection included a confinement facility with concrete floors that were washed daily and an unaerated overflow lagoon. The data indicated the mean COD/TS ratio for fresh swine feces to be 1.08 grams per gram, the BOD5/TS ratio to have a mean of 0.33 grams per gram, and the VS/TS ratio to have a mean of 0.82. This study indicated that for a 100 lb. hog, the daily COD in the waste was 0.64 pounds; BOD 0.31 pounds; total solids 0.48 pounds and volatile solids 0.33 pounds. The membrane filter technique outlined in Standard Methods for the determination of the fecal streptococcus content of swine wastes was superior to the membrane filter technique utilizing KF broth. (Miner-Iowa State)
W71-05436

DIFFUSIVITY OF OXYGEN IN AQUEOUS ELECTROLYTE SOLUTIONS,
Auburn Univ., Ala. Dept. of Chemistry.
For primary bibliographic entry see Field 01B.
W71-05454

MARINE CHEMICAL POLLUTANTS (METHODS OF STUDY AND RESULTS), (FRENCH),
Centre d'Etudes et de recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, J. Aubert, S. Daniel, and B. Donnier.
English Summaries. Revue Internationale D'Oceanographie Medicale, Vol 17, p 67-77, 1970. 3 tab, 11 ref.

Descriptors: *Industrial wastes, *Chemical wastes, *Toxicity, Marine animals, Marine plants, Food chains, Analytical techniques, Chemical analysis.

A method of analysis for estimating the toxicity of some chemical pollutants to flora and fauna is presented. The method measures the toxicity threshold for four links in the marine biological chain and shows the transmission of the toxin from phytoplankton to zooplankton to fish and finally to small mammifers. Results are given for several different industrial wastes. Kraft cellulose and metallic oxides were found to be the most toxic. (Ensign-PAI)
W71-05501

MICROBIOLOGICAL DETERMINATION OF METHYL-MERCURY,
Aarhus Univ. (Denmark). Inst. of Hygiene.
J. C. Hansen.
Vatten, Vol 4, p 365-368, 1970. 1 tab, 2 fig, 20 ref.

Descriptors: *Microbiology, *Oranic material, *Ecology, Food chains, Foods, Toxins, Toxicity, Pollutant identification, Water pollution effects.
Identifiers: *Microbiological technique, *Methyl mercury extraction, *Total mercury, *Demethylation.

Inorganic mercury in sediments has been found to methylate to methyl mercury and transfer to water soluble compounds thus allowing the mercury to accumulate in the food chains with the eventuality of harming human beings. A microbiological technique for determining the total content of mercury in organic material of foodstuffs, and the determination of the quantity of organic mercury appearing as methylated mercury is described. (Ensign-PAI)
W71-05505

ISOLATION OF SALMONELLA FROM A POLLUTED MARINE ENVIRONMENT, TECHNIQUE AND ENRICHMENT MEDIA,
Aarhus Univ. (Denmark). Inst. of Hygiene.
K. Grunnet, A. Gundstrup, and G. J. Bonde.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 165-177, 1970. 3 tab, 1 fig, 17 ref.

Descriptors: *Bioindicators, *Salmonella, *E. coli, *Coliforms, *Streptococcus.
Identifiers: *Technique, *Media, *Gulf of Aarhus.

Results of experiments over two years of the Salmonella frequency in the polluted Gulf of Aarhus are discussed. An approximate rectilinear relationship is found between the E. coli count and the frequency of Salmonella. Twenty five various serotypes were isolated. The number of isolates belonging in the S. typhimurium and S. paratyphi B groups with different concentrations of E. coli indicated a quicker die-away rate for S. typhimurium than for S. paratyphi B at E. coli counts lower than 300 per 100 ml. Investigations of bottom sediments, aquatic plants, mussels, and fish were also conducted. In very polluted areas salmonellas were detected in samples of all the categories mentioned except fish. (Ensign-PAI)
W71-05516

OCEAN OUTFALL DISPERSION,
Oregon State Univ., Corvallis.
Wesley James, and Fred J. Burgess.
Photogrammetric Engineering, Vol 36, No 12, December 1970, p 1242-1250. 8 fig, 1 tab, 15 ref. FWPCA Project 16070 ENS.

Descriptors: *Aerial photography, Wastes, Outlets, *Dispersion, Currents, Remote sensing, Pollutant identification.

Evaluations of waste concentrations, dispersion processes, and current patterns by aerial photography are described. This aerial technique has possibilities for a precise method for determining outfall waste concentrations remotely. Data from this method can then be subjected to computer analysis and displays of results generated. This technique may offer more comprehensive results than conventional boat sampling. (Ensign-PAI)
W71-05521

SOME BIOGEOCHEMICAL CONSIDERATIONS ON THE RADIOACTIVE CONTAMINATION OF MARINE BIOTA AND ENVIRONMENTS,
International Laboratory of Marine Radioactivity, Monte Carlo (Monaco).
Rinnosuke Fukai.
Some Biogeochemical Considerations on the Radioactive Contamination of Marine Biota and

vironments, Paper, Pergamon Press, New York, 69, p 391-394. 1 fig, 1 tab, 7 ref.

escriptors: *Radioactivity, *Trace elements, quatic life, Water pollution effects, Marine imals, Algae, Mollusks, Fish, Radioactive wastes. entifiers: *Biogeochemical data, *Abundance ios.

dioactive contamination of marine environ-nts and biota is a link in the biogeochemical ocess in the sea. The importance of the accumu-ion of biogeochemical data on the distributions trace elements in marine biota in relation to the ediction of radioactive contamination is cussed. The reason for obtaining the 'standard undance' of trace elements for certain groups of rine organisms is explained and the importance the interpretation of the analytical results and mputations of the abundance ratio is mentioned. nsign-PAI)
71-05531

TECTION OF OIL SLICK POLLUTION ON ATER SURFACES WITH MICROWAVE DIOMETER SYSTEMS,
crowave Sensor Systems, Inc., Downey, Calif.; d California Univ., Santa Barbara.
C. Aukland, W. H. Conway, and N. K. Sanders.
mote Sensing of Environment, International mposium, Sixth Proceedings. Ann Arbor, chigan, October 13-16, 1969, Vol II, p 789-796, 69. 5 fig, 5 ref.

scriptors: *Oil wastes, *Remote sensing, icrowaves, Pollutant identification, Oily water. ntifiers: Oil slick detection.

ere are two mechanisms by which oil slicks on a ter surface may be detected. An apparent tem-ature anomaly is created when oil is present and s local anomaly against the rather uniform sea nifies the detection of oil pollution. An analyti-basis for the mechanisms is developed and the ults of the experimental verification are sented. It is felt that the primary detection chanism for thin oil films is the change in sea te due to the presence of oil which sends strong nals to microwave radiometers when winds of 6 ots or more are blowing. The mechanism of ect change in the emissivity of the water surface e to the presence of oil is also considered. These detection methods are described separately. sign-PAI)
1-05533

EANOGRAPHIC APPLICATIONS OF MOTE SENSING WITH PASSIVE CROWAVE TECHNIQUES,
rojet General Corp., El Monte, Calif.
T. Edgerton, and D. T. Trexler.
mote Sensing of Environment, International mposium, Sixth Proceedings, Ann Arbor, chigan, October 13-16, 1969, Vol II, p 767-788, 69. 16 fig, 4 ref.

scriptors: *Oil wastes, *Remote sensing, icrowaves, Pollutant identification, Tempera-e, Oily water.
ntifiers: *Scanning radiometers.

seful tool for determination of sea state, sea ice, pollution is passive remote sensing in the rowave spectral region. During aerial surveys of Salton Sea, California and the North Atlantic ean, differences in radiometric brightness tem-ature of the sea surface was readily detected by nning phased array radiometers. Sea State pre-ion by microwave brightness temperature, cor-ted with theoretical models for sea states less n 4 (beaufort). (Ensign-PAI)
1-05534

LTISPECTRAL SENSING OF OIL POLLU-ON,
dix Corp., Ann Arbor. Aerospace Systems Div.; Michigan Univ., Ann Arbor.
D. S. Lowe, and P. G. Hasell.
Remote Sensing of Environment, International Symposium, Sixth Proceedings, Ann Arbor, Michigan, October 13-16, 1969, Vol II, p 755-765, 1969. 6 fig, 2 ref.

Descriptors: *Oil wastes, *Remote sensing, *Ultraviolet radiation, *Infrared radiation, *Thermal radiation, Pollutant identification.
Identifiers: Multispectral imagery, Santa Barbara (Calif).

The University of Michigan conducted multispectral flights over the Santa Barbara oil slick in early March. Imagery made from selected spectral bands ranging from the ultraviolet through the thermal infrared are presented. Analysis of the data is still in progress. (Ensign-PAI)
W71-05535

OPTICAL (INFRARED AND ULTRAVIOLET-VISUAL) REMOTE SENSING OF POLLUTION OF WATER BODIES,
Michigan Univ., Ann Arbor.
M. R. Holter.
1970 IEEE International Conference on Engineering in the Ocean Environment, Panama City, Florida, September 21-24, 1970, Digest of Technical Papers, p 45-50.

Descriptors: *Remote sensing, *Pollutant identification, *Monitoring, *Water pollution control, *Infrared radiation, *Ultraviolet radiation, Oil wastes, Thermal pollution, Color, Lakes.

Experimental results on developing means of remotely sensing material and thermal pollution in various water bodies are presented. These methods of detection and identification of pollutants are described in detail. The results also suggest possibilities of sensing and calculating wave height and motion, subsurface solid features, bottom depths, turbidity and sediment loads. (Ensign-PAI)
W71-05538

MONITORING CONCEPTS AND REQUIREMENTS IN COASTAL WASTES MANAGEMENT,
National Academy of Engineering, Washington, D.C.; and National Academy of Sciences, Washington, D.C.
R. Keim.
1970 IEEE International Conference on Engineering in the Ocean Environment, Panama City, Florida, September 21-24, 1970, Digest of Technical Papers, p 252.

Descriptors: *Monitoring, *Waste disposal, *Water pollution sources, *Coasts, *Pollutant identification, *Water quality control, Pesticides, Biomass, Trace elements, Heavy metals, Organic wastes.

An evaluation was made of the scientific and engineering requirements for research for further development of our capabilities to protect the marine environment. The National Academy of Engineering and the National Academy of Sciences jointly conducted the investigation. A quantitative guideline to marine receiving water values, and a monitoring program to improve monitoring capabilities is indicated. (Ensign-PAI)
W71-05540

NUTRIENT STUDIES IN HYPER-FERTILIZED ESTUARINE ECOSYSTEMS: I. PHOSPHORUS STUDIES,
Gulf Coast Research Lab., Ocean Springs, Miss.
For primary bibliographic entry see Field 05C.
W71-05550

MONTHLY VARIATION IN PHOSPHATE AND RELATED CHEMICALS FOUND IN THE SEDIMENT IN THE ISLAND AREA OF LAKE ERIE, 1967-68, WITH REFERENCE TO SAMPLES COLLECTED IN 1964, 1965, AND 1966,
John Carroll Univ., Cleveland, Ohio; and Ohio State Univ., Columbus.
Edwin J. Skoch, and N. Wilson Britt.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 325-340, 1969. 16 p, 6 fig, 3 tab, 33 ref. OWRR Project A-008-OHIO (2).

Descriptors: *Sampling, *Bottom sediments, *Lake Erie, *Phosphates, Iron, Organic matter, Chemical analysis, Data collections, Water chemistry, Eutrophication, Nutrients, Path of pollutants, Great Lakes.

Samples of sediment collected in Lake Erie in 1964, 1965, 1966, and on a monthly basis from May, 1967 through November, 1968 were analyzed for total phosphate, iron and organic carbon. Samples were collected by means of an Ekman Dredge and by coring. The cores were sectioned at 2.5 cm intervals and each of the six sections was analyzed. Results of the analyses showed only a slight increase on phosphate since 1964. However all three factors showed a definite increase from May, 1967 through November, 1968. Monthly variation was quite distinct and more severe than the differences between years. The sediment was found to consist of two distinct layers, with the upper 5 cm of sediment usually higher in concentrations of materials than the lower portions. (See also W71-05561) (Knapp-USGS)
W71-05571

COLORIMETRIC METHODS FOR BROMINE,
Illinois State Water Survey, Champaign. Chemistry Section.
For primary bibliographic entry see Field 05F.
W71-05576

GAS CHROMATOGRAPHIC ANALYSIS OF MERCAPTANS, PHENOLS, AND ORGANIC ACIDS IN SURFACE WATERS WITH USE OF PENTAFLUOROBENZYL DERIVATIVES,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Fed K. Kawahara.
Environmental Science and Technology, Vol 5, No 3, p 235-239, March 1971. 5 p, 8 fig, 3 tab, 9 ref.

Descriptors: *Gas chromatography, *Organic acids, *Phenols, *Pollutant identification, Organic matter, Water analysis, Monitoring, Sampling, Chemical analysis.
Identifiers: *Mercaptans.

As organic interferences are present in surface water samples, qualitative and quantitative measurements of 0.1 microgram of phenols and (or) organic acids are extremely difficult to make when flame-ionization detection is used in gas-liquid chromatography. By converting the unidentified mercaptans, phenols, and organic acids to pentafluorobenzyl thioethers, ethers, and esters, respectively, subnanogram amounts of these compounds can be separated qualitatively and determined quantitatively by electron capture gas chromatography even with a 95% organic interference. The weak and strong acid fractions obtained from the chloroform extracts of the carbon adsorption samples collected at two field stations were analyzed. (Knapp-USGS)
W71-05577

A DISCUSSION OF THE CHEMICAL CHARACTER OF WATER MIXTURES,
California Univ., Berkeley. Dept. of Chemistry.
For primary bibliographic entry see Field 05B.
W71-05582

THE DETERMINATION OF LOW LEVELS OF COBALT-60 IN ENVIRONMENTAL WATERS BY LIQUID SCINTILLATION COUNTING,
Geological Survey, Denver, Colo.

H. C. Claassen.
Analytica Chimica Acta, Vol 52, p 229-235, 1970. 7 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Cobalt radioisotopes, *Radiochemical analysis, *Analytical techniques, *Methodology, Water chemistry, Hydrologic aspects, Ion exchange, Sediments, Soils, Soil water, Radioactive waste disposal.
Identifiers: *Cobalt-60, *Scintillation counting, Environmental waters.

Radioactive isotopes of cobalt may be present in waters, fluvial sediments, or soil samples as a result of nuclear detonations, radioactive waste disposal, or cobalt tracer studies. To evaluate movement of radiocobalt in hydrologic systems and to determine the cobalt-60 used in establishing equilibrium constants, distribution coefficients, reaction rates, and sorption equilibria, an outline is developed of methods used and an experimental procedure is described. Cobalt-60 is determined in waters at levels greater than 0.5 pCi per sample; a modification of the method may be used to analyze fluvial sediments and soils. After the cobalt has been separated, first as the hydroxide and then as the thiocyanate complex in methyl isobutyl ketone, it is counted in a liquid scintillation system at 80% efficiency. Separation factors achieved for six isotopes are generally greater than 2,000. The time for an analysis, exclusive of the counting and evaporation operations, is about 2 hr. (Lang-USGS)
W71-05590

MERCURY ADSORPTION OF CHROMIUM OXIDE GELS,
Brunel Univ., Uxbridge (England). Dept. of Chemistry.
F. S. Baker, and K. S. W. Sing.
Nature Physical Science, Vol 229, No 1, p 27, January 4, 1971. 1 p, 7 ref.

Descriptors: *Pollutant identification, *Adsorption, *Chromium, *Heavy metals, *Gels, Investigations, Methodology, Test procedures, Vapor pressure, Laboratory tests, Oxides.
Identifiers: *Mercury, *Mercury adsorption.

With certain chromium oxide gels, a significant amount of mercury vapor adsorption takes place at temperatures around 298 K. During prolonged outgassing of chromium oxide gels at 298 K, the weight of the sample decreased to a minimum (after 2-3 h) and then underwent a slow but uniform rate of increase. The weight change was arrested by the introduction of a small pressure of a permanent gas, but the same rate of increase was restored on further outgassing. When a similar experiment was performed using a microbalance (in place of the spring balance) and a mercury-free adsorption system, no increase in weight could be observed. It seemed likely that the weight increase was due to the adsorption of mercury vapor, which originated from various exposed mercury surfaces in the system (for instance the manometer). To test this hypothesis the mercury vapor pressure was increased three-fold by increasing the temperature of a mercury reservoir; immediately, the rate of increase in weight of the adsorbent was accelerated (initially two-fold). (Woodard-USGS)
W71-05598

MICROCOLUMN CHROMATOGRAPHIC CLEANUP FOR THE ANALYSIS OF PESTICIDES IN WATER,
Geological Survey, Menlo Park, Calif. Water Resources Div.
LeRoy M. Law, and Donald F. Goerlitz.
Journal of the Association of Official Analytical Chemists, Vol 53, No 6, p 1276-1286, November 1970. 11 p, 5 fig, 6 tab, 23 ref

Descriptors: *Pesticide residues, *Chemical analysis, *Gas chromatography, *Pesticide removal, *Methodology, Gels, Adsorption, Separation techniques, Pesticides, Aldrin, Dieldrin, Endrin, Heptachlor, Agricultural chemicals, Phosphothudate pesticides
Identifiers: *Pesticide removal (Alumina method), Silica gel method, Florisil method.

Rapid and economical removal of extraneous coextractives from pesticide residue extracts of water is made possible by the use of micro-cleanup columns. Three adsorbents--alumina, silica gel, and Florisil--as well as a variety of solvent systems were investigated. The recovery and cleanup of aldrin, chlordene, dieldrin, endrin, heptachlor, heptachlor epoxide, hexachlorobicycloheptadiene, hexachlorocyclopentadiene, isodrin, lindane, and methoxychlor were satisfactory, using any of the 3 adsorbents. The phosphorothioate pesticides malathion, methyl parathion, and parathion, however, could not be successfully recovered from Florisil when a modified Mills procedure was attempted. The micro-cleanup columns may also be used to perform a preliminary separation of a number of compounds that are difficult to resolve by gas-liquid chromatographic. (Woodard-USGS)
W71-05614

FUNGI ASSOCIATED WITH THE ACTIVATED-SLUDGE PROCESS OF SEWAGE TREATMENT AT THE LEBANON, OHIO, SEWAGE-TREATMENT PLANT,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Research Lab.
For primary bibliographic entry see Field 05D.
W71-05624

SOME ALGAE OF THE UPPER CUYAHOGA RIVER SYSTEM IN OHIO,
Kent State Univ., Ohio. Dept. of Biological Sciences.
Russell G. Rhodes, and Anthony J. Terzis.
The Ohio Journal of Science, Vol 70, No 5, p 295-299, September 1970. 1 fig, 1 tab, 16 ref.

Descriptors: *Algae, Ohio, Chlorophyta, Chrysophyta, Rhodophyta, Cyanophyta, Euglenophyta.
Identifiers: *Cuyahoga River (Ohio), Cladophora, Aphanochaete, Rhizoclonium, Vaucheria, Tribonema, Oscillatoria.

Sixty-four species of algae were found in a qualitative survey made during June and September, 1967, in three tributaries of the Cuyahoga River in Geauga County: West Branch, East Branch, and Tare Creek. Eight species which were collected at the majority of the 14 stations sampled are Cladophora glomerata, Aphanochaete repens, Rhizoclonium hieroglyphicum, Euglena gracilis, Vaucheria sessilis, Tribonema bombycinum, Oscillatoria nigra, and O. limosa. (Little-Battelle)
W71-05629

BANGIA ATROPURPUREA (ROTH) A. IN WESTERN LAKE ERIE,
Ohio State Univ., Columbus. Dept. of Botany.
Jack Kishler, and Clarence E. Taft.
The Ohio Journal of Science, Vol 70, No 1, p 56-57, January 1970. 1 fig, 5 ref.

Descriptors: *Rhodophyta, *Lake Erie, Ohio, Algae.

Bangia atropurpurea was collected 2 March 1969 at the State Highway Park on the east shore of Marblehead Peninsula, Ottawa County, Ohio. This is the first record of Bangia in western Lake Erie. It appeared as lax red-purple tufts, 3/4 inch long, covering a flagstone on the shoreline where there was an opening in the ice. (Little-Battelle)
W71-05630

THE AUTOMATIC EXTRACTION, IDENTIFICATION AND DETERMINATION OF QUINIZARIN IN HYDROCARBON OILS,
Ministry of Technology, London (England). Lab. of Government Chemist.
K. B. E. Tucker, R. Sawyer, and P. B. Stockwell.
Analyst, Vol 95, p 730-737, August 1970. 8 fig, 4 tab, 8 ref.
Descriptors: *Oil, *Separation techniques, *Spe
trophotometry, Detergents, Oil wastes.
Identifiers: *Quinizarin.

Identification and determination of the quinizar
present in oil has been achieved by linking the so
vent-extraction system with a flow-through cell of
recording spectrophotometer. Quinizarin
identified by the characteristic spectral pattern ar
determined by the peak height of the 521 nm pea
(Little-Battelle)
W71-05633

OPTIMUM EXPERIMENTAL CONDITION FOR HYDROCARBON TYPE ANALYSIS B CHROMATOGRAPHY,
Laxminarayan Inst. of Tech., Nagpur (India).
A. K. Sinha, and K. A. Venkatachalam.
Indian Journal of Technology, Vol 8, p 266-26
July 1970. 5 tab, 6 ref.

Descriptors: *Oil, *Aromatic compounds, *Poll
tant identification, Chromatograph
Fluorescence, Oil wastes, Silica, Gels, Sulfur co
pounds.
Identifiers: *Fluorescent indicator adsorptio
*Hydrocarbons, Olefins, Paraffin, Chemical inte
ference.

The results of a study aimed at establishing the o
timum conditions for the fluorescent indicator a
sorption analysis of hydrocarbon mixtures, usi
anthracene as the fluorescent aromatic indicat
and nitrogen tetroxide saturated silica gel as t
visual marker for olefins are presented. Best resol
tion is obtained on using dry silica gel. (Little-Ba
telle)
W71-05634

ANALYSIS OF PLANTS, SOILS AND WATER FOR NITRATE BY USING AN ION-SELECTIV ELECTRODE,
New South Wales Dept. of Agriculture (Australia
Biological and Chemical Research Inst.
P. J. Milham, A. S. Awad, R. E. Paull, and J. H. Bull.
Analyst, Vol 95, p 751-757, August 1970. 1 fig, tab, 27 ref.

Descriptors: *Electrode, *Anion exchange, *Fre
water, *Nitrates, Soil analysis, Plants, Instrument
tion, Analytical techniques.
Identifiers: Chemical interference.

The use of a commercial anion-exchange electro
permits the rapid determination of nitrate in pla
material and in non-saline soils and waters. Th
buffer used eliminates chloride, nitrite and organ
anion interferences. The proposed method giv
better recovery and reproducibility than the Deva
da method. When the nitrate-nitrogen concentr
tion of non-saline extracts and waters is great
than 2 p.p.m., the method gives results of plus
minus 1 to 3%. Analysis time is extraction time pl
1 minute. Interferences were no problem with th
proposed method. (Little-Battelle)
W71-05636

POTENTIOMETRIC NITRATE ANALYSIS: FLOW-THROUGH ELECTRODE UNIT,
New South Wales Dept. of Agriculture (Australia
Div. of Science Services.
Paul J. Milham.
Analyst, Vol 95, p 758-759, August 1970. 1 fig, tab, 5 ref.

Descriptors: *Nitrates, *Electrodes, *Io
exchange, Instrumentation, Plants, Analytic
techniques.

A flow-through electrode unit for use with a liqu
ion-exchange nitrate electrode is described. Tem
perature control to within plus or minus 0.5C
25C and reproducible stirring of the test mediu
give a mean coefficient of variation of 0.36 per ce
for standards and 0.63 per cent for plant extract
The average time for each nitrate concentratio
measurement is halved. (Little-Battelle)

5637

R-CO SUB 2 EXCHANGE SET-UP FOR OUTINE 18-OXYGEN ASSAY OF NATU-VATERS,
il for Scientific and Industrial Research, Pre-South Africa). National Physical Research

ng Roether.
tional Journal of Applied Radiation and es, Vol 21, p 379-387, 1970. 5 fig, 18 ref.

otors: *Spectrometer, *Radiochemical anal- Carbon dioxide, Water analysis, sotopes, Oxygen, Analytical techniques.
ers: *Oxygen-18, *Sample preparation, ration.

procedure of sample preparation for assay-er for the oxygen-18 isotope is described. It d on the common principle of equilibrating ter samples with carbon dioxide gas, the c composition of which is then analyzed in ss spectrometer. However, handling time is d to about ten minutes per sample by operat-eral samples in parallel and by pumping the n the equilibration vessels through capillary vithout freezing down the water samples. pillaries control the loss of water vapour and t mixing of the samples. The vessels are during pumping and during the equilibra-ne isotopic enrichment caused by the vapour s found to be about 0.1 per mille for one ml s, and it is proportionally smaller for larger s. For 10 ml water samples at 18 degrees C, racteristic time for equilibration drops by an f magnitude between 2 and 3.5 c/s shaking ncy after which it levels off to 18 minutes; w step is then the hydration reaction of the ed carbon dioxide. The standard reproduci-f sample preparation is better than plus or 0.03 per mille and no difference has been de-in isotopic composition to that of samples ed in the classical manner. (McCann-Bat-

5640

DENTIFICATION AND MEASUREMENT HLORINATED HYDROCARBON PESTI-IN SURFACE WATERS,
Water Pollution Control Administration, gton, D.C. Div. of Pollution Surveillance.
Breidenbach, J. J. Lichtenberg, C. F. Henke, nith, and J. W. Eichelberger, Jr.
ble from: Analytical Quality Control Labora-014 Broadway, Cincinnati, Ohio 45202. WP-ember 1966. 70 p, 38 fig, 2 tab, 71 ref.

otors: *Gas chromatography, *Sampling, roscopy, Organic pesticides, Carbon, Bot-liments, Solvent, Measurement, Separation ues, Endrin, Dieldrin, DDT, Aldrin, Hep- Spectrophotometry, *Chlorinated arbon pesticides.
ers: *Carbon adsorption, *River water, Sen- FWQA methods, Hexane-benzene, Sample tion, Chemical interference, Electron cap-s chromatography, Pumps, Lindane, Hep- epoxide, Methorychlor, Toxaphene, DDE, ane, Parathion, Methyl parathion, Ovex, DDD, Infrared spectrophotometry.

mprehensive review of the methodology ed by the Surveillance System laboratories CA for analysis of chlorinated hydrocarbon es includes details on carbon adsorption g; sample collection; preparation of sam-gas chromatographic analysis; gas chro-aphy; infrared spectrophotometry; solvent and other chemical interferences; sensitivi-specificity of the methods; and pumping . Chromatograms, sample calibration infrared spectra from samples, structural e, equipment, solvents and reagents, and eral composition of carbon chloroform and alcohol extracts are discussed and illus-Little-Battelle)
5641

DIRECT DETERMINATION OF ELEMENTAL PHOSPHORUS BY GAS-LIQUID CHROMATOGRAPHY,
Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.
R. F. Addison, and R. G. Ackman.
Journal of Chromatography, Vol 47, p 421-426, March 1970. 4 fig, 2 tab, 10 ref.

Descriptors: *Phosphorus, *Gas chromatography, *Flame photometry, Water, Mud, Bioassay, Separation techniques, Chemical analysis.
Identifiers: Gas-liquid chromatography.

A recent problem of pollution of Newfoundland waters by yellow phosphorus led to the development of an alternative method of phosphorus analysis. The method employs gas-liquid chromatography, since (a) phosphorus is relatively low-boiling and volatile, and has been gas chromatographed, and (b) the development of various phosphorus-specific detectors allows the detection of as little as 10 to the -12th power g of this element. As in the classical approach phosphorus is partially isolated by extraction into a suitable organic solvent; a sample of this extract is then subjected to GLC, and the phosphorus response is compared to that of standards. Application of the method to the analysis of water, mud and biological samples is described. Advantages of the method are specificity, sensitivity, and rapidity of analysis over methods currently in use. (McCann-Battelle)
W71-05644

RELIABLE TESTS FOR PESTICIDES NOW AVAILABLE.

Science Journal, Vol 6, No 5, p 19-20, May 1970.

Descriptors: *Test procedures, *Dieldrin, *Fish, *Pesticides toxicity, Minnows, Thermal pollution, Bioassay.
Identifiers: *Tarpon.

A method for determining the toxicity of pesticides to fishes may eliminate inconsistencies in limits on their use. A study by Drs. C. E. Land and D. B. Seba at the University of Miami Rosenstiel School of Marine and Atmospheric Sciences showed that with most test procedures now used, much of the pesticide is rapidly lost from the test solution by vaporization or by fixation to containers. A test procedure for dieldrin has been developed in which these losses do not occur. In this method, the dieldrin is emulsified and the solution is circulated to the apparatus where the fish are exposed under controlled conditions. Exposure of tarpon by this method has shown that blood concentration of a pesticide is not a dependable indicator of its toxicity. Rather environmental conditions cause variations in sensitivity. The gill may be the primary route of pesticide intake in fish. (Little-Battelle)
W71-05645

CURRENT PROGRESS IN THE DETERMINATION OF THE POLYCHLORINATED BIPHENYLS,
California Univ., Berkeley. Inst. of Marine Resources.
R. W. Risebrough, P. Reiche, and H. S. Olcott.
Bulletin of Environmental Contamination and Toxicology, Vol 4, No 4, p 192-201, 1969. 18 ref. NSF Grant GB6362.

Descriptors: *DDT, *Gas chromatography, *Pollutant identification, Spectrometers, Fish, Birds, California.
Identifiers: *Polychlorinated biphenyls, Toxaphene, DDD, Nitration, Saponification, Chemical interference.

The general problem is reviewed of the pervasiveness of pesticide residues in fish and water fowl and conclude that in many cases, DDT and its derivatives have been erroneously identified in place of PCBs. They then describe the characteristics of gas chromatography and chemical methods which enable the analyst to differentiate PCBs from toxaphene, DDT, and DDD. (Little-Battelle)
W71-05646

MAYFLIES OF THE GENUS STENONEMA AS INDICATORS OF WATER QUALITY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Philip A. Lewis.
Available from: Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. For presentation at the 17th Annual Meeting of the Midwest Benthological Society, Kentucky Dam Village State Park, Gilbertsville, Kentucky, April 9-11, 1969. 13 p, 3 fig, 1 tab, 13 ref.

Descriptors: *Mayflies, *Bioindicators, *Organic wastes, *Ohio River, Dissolved oxygen, Analytical techniques, Water quality, Water pollution effects, Nutrients.
Identifiers: *Wabash River, *Little Miami River.

As a group, species of the genus Stenonema have not been widely used as pollution indicators because the taxonomy and ecology have not been well defined and the environmental requirements of individual species are yet to be determined. Several basket samples were collected during 1967 from the Ohio River, the Little Miami River, and the Wabash River and analyzed for Stenonema. Analysis of the samples and comparison of the results with those of other authors showed that the definition of the species is incomplete. A thorough description of the Stenonema obtained in the basket samples and their identifying features are included. Data are also given on the numbers of Stenonema collected at the various locations in the rivers. Stenonema integrum was abundant in samples affected by organic wastes. In the Little Miami River, S. pulchellum and S. interpunctatum are able to thrive in spite of organic enrichment because of aerated water. (Little-Battelle)
W71-05647

DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
Yiu-Kee Chau, and Hirohumi Saitoh.
Environmental Science and Technology, Vol 4, No 10, p 839-841, October 1970. 2 fig, 1 tab, 12 ref.

Descriptors: *Spectroscopy, *Heavy metals, Pollutant identification, Separation techniques, Fresh water.
Identifiers: *Mercury, Dithizone extraction, Spectrophotometer, Sample preservation, Atomic absorption spectroscopy.

A simple and sensitive method for the determination of submicrogram amounts of mercury in lake water was developed by combination of concentration by dithizone extraction and gas-phase atomic absorption. The mercury was first extracted by dithizone, back extracted by hydrochloric acid, and then converted to vapor by a reduction-aeration reaction. A sensitivity of 0.008 micrograms per liter (0.008 p.p.b.) was achieved for water analysis. (Little-Battelle)
W71-05648

A SPECTROPOLARIMETRIC TITRIMETRIC METHOD FOR THE DETERMINATION OF CADMIUM, MERCURY, LEAD AND BISMUTH,
Texas A and M Univ., College Station. Dept. of Chemistry.
R. J. Palma, Sr., and K. H. Pearson.
Analytica Chimica Acta, Vol 49, p 497-504, March 1970. 3 fig, 3 tab, 11 ref.

Descriptors: *Volumetric analysis, *Ions, *Pollutant identification, Chelation, Hydrogen-ion concentration, Heavy metals.
Identifiers: *Cadmium, *Lead, *Bismuth, *Spectropolarimetric titrimetry, *Mercury, Polarimeter, Propylenediaminetetraacetric acid.

Spectropolarimetric methods of analyses of cadmium (II), lead (II) and bismuth (III) were developed, based on the stereospecific ligand, D- (-)-1,2-propylenediaminetetraacetic acid (D (-)PDTA). The optical rotation of the solution was monitored with a photoelectric polarimeter to determine the end-point of the titration. The effects of pH, wavelength, and dilution are discussed and the optimum conditions for the determination of each metal are established. The range of accurate analyses at 365 nm was 0.1 minus 0.001 m for cadmium (II), and 0.1 minus 0.0001 m for lead (II), mercury (II), and bismuth (III). The range of the average deviations from visual cholometry for the four metals titrated was 0.05 minus 0.29%. (Little-Battelle)
W71-05649

ANALYSIS OF FROZEN AQUEOUS SOLUTIONS BY SPARK SOURCE MASS SPECTROSCOPY,
Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
E. B. Owens.
Analytical Letters, Vol 3, No 5, p 223-234, 1970. 2 fig, 1 tab, 9 ref.

Descriptors: *Spectroscopy, *Aqueous solutions, *Pollutant identification, *Heavy metals, Copper, Iron, Chromium, Potassium, Chlorine.
Identifiers: *Spark-source mass spectroscopy, Indium, Zinc, Nickel.

Aqueous solutions containing metals and other elements dissolved by acids were analyzed with a spark source mass spectrograph sparking to the frozen samples. The elements investigated were In, Zn, Cu, Ni, Fe, Cr, K, Cl. The minimum detection limit obtained from a 10 to the -8th power coulomb exposure is about 5 x 0.0000001 M solution concentration. Analytical precision of 8 to 30% relative is achieved through use of an internal standard. (Little-Battelle)
W71-05650

ENVIRONMENTAL MERCURY: RAPID DETERMINATION IN WATER AT NANOGRAM LEVELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Robert W. April, and David N. Hume.
Science, Vol 170, No 3960, p 849-850, November 20, 1970. 2 fig, 2 ref.

Descriptors: *Spectrophotometry, *Pollutant identification, Heavy metals, Seawater, Massachusetts, Sewage.
Identifiers: *Mercury, *Plasma emission spectroscopy, Radiofrequency helium plasma, Charles River (Massachusetts).

Mercury compounds and free mercury are determined by emission spectrophotometry in a radiofrequency helium plasma. The method is simple, rapid, directly applicable to environmental water samples, and subject to few interferences. The useful working range is 10 nanograms to 10 micrograms, or 1 part per billion to 1 part per million in 10 milliliters of sample. The limit of detection is about 2 nanograms. (Little-Battelle)
W71-05651

A ROTATING SAMPLING ARM--AN AID TO AUTOMATIC ANALYSIS OR SAMPLING,
Upper Tame Main Drainage Authority, Birmingham (England).
J Phillips
Water Research, Vol 3, p 907-909, 1969. 2 fig, 1 ref

Descriptors: *Chemical oxygen demand, *Sampling, *Automation, *Mechanical equipment.

The sampling arm developed carried a glass sampling probe which on an initial signal drops into the sample for uptake of the required aliquot. The next signal causes the arm to life the probe out of the sample, rotate it to a set position above a receiving vessel and drop the probe into the vessel. After discharge of the sample that is taken the arm lifts and returns to its original position. The vertical movement of the arms is controlled by a solenoid attached to the pivoted arm which lifts when the solenoid is energized and drops as the solenoid is de-energized. Rotation of the arm is by means of a synchronous motor which will function in both forward and reverse directions. (Little-Battelle)
W71-05652

THE COURSE OF BIODEGRADATION OF ANIONIC DETERGENTS BY ANALYSES FOR CARBON, METHYLENE BLUE ACTIVE SUBSTANCE AND SULFATE ION,
Department of Agriculture, Philadelphia, Pa. Eastern Utilization Research and Development Div.
For primary bibliographic entry see Field 05B.
W71-05653

ANALYSIS OF TIME-VARIANT BEHAVIOR OF WATER CHEMISTRY,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 02K.
W71-05705

RECOVERY, SEPARATION, AND IDENTIFICATION OF PHENOLIC COMPOUNDS FROM POLLUTED WATERS,
Rutgers - The State Univ., New Brunswick, N. J. Dept. of Environmental Sciences.
Samuel D. Faust, Stutz Hansjakob, Osman M. Aly, and Peter W. Anderson.
Available from NTIS as PB-198 030, $3.00 in paper copy, $0.95 in microfiche. New Jersey Water Resources Research Institute, New Brunswick, Final Report, January 1971. 56 p, 8 tab, 5 fig, 16 ref. OWRR Project A-020-NJ (1).

Descriptors: *Phenol, *Industrial wastes, *Pollutant identification, Taste, Odor, Water pollution sources, *Chemical analysis, Rivers, Groundwater.

A four-year research program was completed wherein the rivers and groundwaters of New Jersey were sampled and tested for phenolic compounds. These chemicals originated in industrial manufacturing processes and are discharged into rivers and groundwaters through the waste waters. Over 500 samples in this four year program were collected from nearly all of the rivers in New Jersey. Several samples were drawn from the deep wells in the Camden, New Jersey, area. Approximately 71% of the samples contained these phenols in quantities that exceeded the potable water quality standard of 1 part per billion established by the New Jersey Environmental Protection Agency. Also, extensive chemical detective work led to the identification of several phenols in the Raritan River and Assunpink Creek. A chemical test was discovered for the detection and identification of phenols that originate in industrial waste waters. Phenols are a water pollutant in that they have the chemical property of imparting tastes and odor to drinking water. These tastes and odors are often described as being 'medicinal', 'chemical', 'aromatic', and 'iodine'. This new chemical test will help pollution abatement officials to trace this type of pollution to its source.
W71-05768

MONITORING OF THE MARINE ENVIRONMENT FOR WASTE COMPONENTS AND FOR EFFECTS OF THE INTRODUCED WASTES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
William B. Davis.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p II 1-II 41. 4 tab, 183 ref.

Descriptors: *Wastes, *Water pollution *Aquatic environment, *Monitoring, Oxyg mand, Nutrients, Chemical, Radioactivity, T pollution, Bacteria, Pollutant identification. Identifiers: Monitoring systems, Research ne

A monitoring program is a necessary part of tive pollution control. Water pollution is a variate condition which necessitates reco and confirmation of a contaminated condit chemists, biologists and engineers with th possible tests in order to initiate steps prevention. Recognition of changing con requires knowledge of the normal water ments and properties. Analytical proceedu strumentation, and modeling for exact defini the state of flux for a precise location and necessary. The complete spectrum of ch substances and a multi-species ecosystem sh considered when monitoring pollutants in an ry. The capability for measurement of any po and a method for rapid location of its sourc be made possible and practical. These possi along with additional research needs are dis (See also W71-05787) (Ensign-PAI)
W71-05789

WASTE DISCHARGE MONITORING,
California Univ., Berkeley. Div. of Hydrau Sanitary Engineering.
Erman A. Pearson.
Background Papers on Coastal Wastes M ment, prepared for National Academy of S Committee on Oceanography and the N Academy of Engineering Committee of Oce gineering, Wash, DC, Vol 1, 1969, p IV 1-I fig, 3 tab, 1 ref.

Descriptors: *Wastes, *Monitoring, *Wate tion sources, *Water pollution control. Identifiers: Methods, Metering, Sampling.

Reasonably accurate information on all sources and the variability in magnitude of t lutant characteristics of the sources are ne for effective control of water pollution. Qua assessment of the waste streams, where po originate, is the most effective way of assess trend of pollutant concentrations. Quan data for both municipal and industrial discharge characteristics is needed. Sta descriptions of the pollutant mass emission waste streams are indicated. The meth sampling, metering, and analysis of pollut these waste streams and the justification for ing this data are presented. (See also W71- (Ensign-PAI)
W71-05791

5B. Sources of Pollution

A PRELIMINARY STUDY OF THE RELA SHIPS BETWEEN STREAM WATER QU AND WATERSHED CHARACTERISTICS THE TRUCKEE RIVER,
Nevada Univ., Reno. Center for Water Res Research.
For primary bibliographic entry see Field 05
W71-05338

MANAGEMENT OF AGRICULT RESOURCES TO MINIMIZE POLLUTIO NATURAL WATERS,
Iowa State Univ., Ames. Dept. of Agricultu gineering.
For primary bibliographic entry see Field 05
W71-05341

SLUDGE DUMPING IN THE THAMES E RY,
Ministry of Agriculture, Fisheries and Foods ham-on-Crouch (England). Fisheries Lab.
R. G. J. Shelton.
Marine Pollution Bulletin, Vol 2, No 2, p February 1971. 4 p, 8 fig, 4 ref.

tors: *Water pollution sources, *Sludge l, Wastes, Estuaries, Investigations, ng, Sediments, Methodology, Evaluation, ed oxygen, Organic matter, Benthic fauna, Marine animals, *Waste disposal, Water n effects.
ers: *Thames estuary (England).

mping of sludge produced at the main Lon- wage works at Becton and Crossness has ed in the outer Thames Estuary since 1887, he present time more than five million tons eight) of digested sewage sludge is dumped ar in the Barrow Deep. The water content don sludge is variable but is normally over he objectives of this study, which is a nary report, were to determine to what ex- e effects of sludge dumping could be de- y examination of the sediments and bottom f the outer Thames Estuary. Samples were d at 66 stations extending from Sea Reach, the Barrow, Black and Middle Deeps to the East Swin. The main concentration of matter (up to 5.7%) was in Sea Reach. etes were found at all stations, being y more numerous in the Black Deep than at in the Barrow and Middle Deeps. rd-USGS)
342

MINATION OF HYDROCARBONS IN TER EXTRACTS OF CRUDE OIL AND OIL FRACTIONS,
Hole Oceanographic Institution, Mass.
ylan, and B. W. Tripp.
Vol 230, No 5288, p 44-47, March 5, p, 4 fig, 3 tab, 11 ref.

tors: *Pollutant identification, *Water pol- ources, *Oily water, Sea water, Solubility, ory tests, Test procedures, *Gas chro- aphy, Oil, Evaluation, Water analysis, Oil Chemical analysis, *Spectroscopy.
ers: Oil pollution, Mass spectroscopy.

omponents of crude oil and kerosene were , identified, and quantitatively determined ater samples. Oil samples were mixed with seawater in different ways to simulate natu- ess of contact between oil and water. The ed samples were transferred to separatory and allowed to stand for 2 hr before the two were separated. The aqueous phase was racted four times with doubly distilled pen- e evaporated residue from the pentane ex- as chromatographed on a Varian Aero- 200 gas chromatograph interfaced to a 4 mass spectrometer. Component struc- ere assigned on the basis of mass spectra, point comparisons and ultraviolet spectra. tration of dissolved compounds was deter- by planimetry of gas chromatographic n each oil or kerosene studied, significant ces in relative amounts of naphthalene nds were observed. (Woodard-USGS)
345

E POLLUTION PROBLEMS IN JAMA-

ty of the West Indies, Kingston (Jamaica). Zoology.
Wade.
Pollution Bulletin, Vol 2, No 2, p 29-30, y 1971. 2 p, 1 fig.

ors: *Water pollution sources, *Sewage ef- *Sewage disposal, *Harbors, Oceans, ollution, Organic matter, Eutrophication, Recreation, Fishkill, Bacteria, Coliforms.
rs: *Kingston (Jamaica), Untreated

no master sewage scheme to dispose of wastes for Kingston's (Jamaica) popula- early half-a-million people. There is an al- al dependence on cesspits. Only the com- industrial and parts of the low income the city situated near the waterfront have any central disposal; this accounts for 5 million gallons of only primary treated sewage disposed into Kingston Harbor each day. In addition, numerous gulleys and drains also discharge organic wastes into the harbor. As a result, the entire northern shore has a bacterial coliform count which indicates that the water may be a potential health hazard for bathers, and other users of the sea-front. Furthermore, the high nutrient content of the water causes eutrophication and red tide blooms and large-scale fish-kills are occurring. The government has recently formed a special committee to conduct a monitoring program of Kingston Harbor in order to determine how far its pollution has advanced and to advise on what corrective measures should be taken in order to reverse the trend. (Woodard-USGS)
W71-05349

A QUANTITATIVE ANALYSIS OF THE EFFECTS OF BATHERS IN RECREATIONAL WATER QUALITY,
Tufts Univ., Medford, Mass. Dept. of Civil Engineering; and New York Sta Rochester.
N. B. Hanes, and A. J. Fossa.
Paper HA-9 presented at the 5th International Water Pollution Research Conference, July-August 1970, p HA-9/1-HA-9/9. 9 p, 9 tab, 14 ref. PHS Training Grant EH-69-647-C.

Descriptors: *Water quality, *Surface waters, *Recreation facilities, *Swimming, *Water supply, Testing, Test procedures, Water pollution, Analysis, Analytical techniques, Chemical analysis, Bacteria, Coliforms, Turbidity, Ammonia, Chlorides.

The effect of recreational uses of water quality was studied using a total of 64 subjects (38 male and 26 female) ages 6 to 38, and a plastic lined 3400-gallon swimming pool, 15 feet long by 10 feet wide and 3.5 feet deep. To reduce spillage, a water depth of 30 inches was used which provided an experimental capacity of 2700 gallons. The pool was filled weekly with water and allowed to stand until the chlorine residual dissipated. Except during periods of bathing, the pool water was filtered continuously through two Diatomaceous Earth spin filters with a combined capacity of 4500 gallons per hour. During an experiment, bathers swam for two consecutive fifteen minute periods. Samples were taken at two stations in the water (six to eight inches below the surface) and one station on the pool wall (also below the water surface). These samples were analyzed for total bacteria, Coliform, Enterococci, Pseudomonas aeruginosa, Turbidity, pH, Ammonia Nitrogen, and Chlorides. The results of this study are tabulated and clearly demonstrate that swimmers have a considerable influence on the bacterial and chemical quality of water. (Woodard-USGS)
W71-05366

LAKES: THE VALUE OF RECENT RESEARCH TO MEASURE EUTROPHICATION AND TO INDICATE POSSIBLE CAUSES,
Marine Dept., Rotorua (New Zealand). Fisheries Research Division.
G. R. Fish.
Journal of Hydrology (New Zealand), Vol 8, No 2, p 77-85, 1969. 1 fig, 2 tab, 18 ref.

Descriptors: *Lakes, *Eutrophication, Nutrients, Industrial wastes, Sewage effluents, Agriculture, Runoff, Nitrates, Phosphates, Ammonium salts, Thermal water, Flooding, Fertilization, Sampling, Flow rates, Rainfall, Evaporation, Springs, Biomass, Nitrogen fixation, Denitrification, Geysers.
Identifiers: Lake Rotorua (New Zealand).

Excessive plant growth in lakes and rivers is probably the most serious impediment to economic use of fresh waters throughout the world. The growth results from artificial enhancement of the fertility of the water, and this eutrophication is caused by large amounts of nutrient salts draining from highly developed catchments. Industrial and sewage effluents probably provide the most important sources of nutrient salts in the continents of America and Europe. Research begun in 1967 to study the physical, chemical, and biological features of Lake Rotorua (New Zealand) disclosed that the water and nutrient budget, calculated for the year June 1967-1968, disclosed that although sewage is an important source of eutrophication, run-off from agricultural land is probably a more important source of plant-fertilizing salts such as nitrate and phosphate. Certain thermal effluents (geysers) provide the major source of ammonium salts. Data collected during a flash flood on a small experimental catchment showed brief but greatly increased leaching of salts from the pastures. The conclusion that agricultural development is the most important cause of eutrophication of local lakes is supported by results published by workers in other parts of New Zealand. (Jones-Wisconsin)
W71-05401

A TECHNICAL ASSESSMENT OF CURRENT WATER QUALITY CONDITIONS AND FACTORS AFFECTING WATER QUALITY IN THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
Norbert A. Jaworski, Donald W. Lear, Jr., and Johan A. Aalto.
Water quality status report. CTSL Technical Report No 5, MAR, March 1969. 55 p, 17 fig, 6 tab, 21 ref.

Descriptors: *Biochemical oxygen demand, *Nutrients, *Dissolved oxygen, *Algae, Coliforms, Eutrophication (Phytoplankton), Estuaries, Water pollution sources, Water pollution effects, Nitrogen, Coliforms, Water quality.
Identifiers: *Potomac River estuary, Nutrient-phytoplankton relationships.

Water quality conditions in the Upper Potomac Estuary including BOD, dissolved oxygen, phosphorus, nitrogen and coliform densities, are presented and discussed. The sources and relationships of nutrients to algal standing crop are studied. Major sources of carbonaceous and nitrogenous oxygen demand as well as the demand from the algal standing crop on dissolved oxygen are evaluated. (Aalto-Chesapeake Technical Support Laboratory)
W71-05407

SANITARY BACTERIOLOGY OF THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05C.
W71-05408

WATER QUALITY AND WASTE WATER LOADINGS UPPER POTOMAC ESTUARY DURING 1969,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
Norbert A. Jaworski.
Water quality status report. CTSL Technical Report No 27, MAR, Nov 1969. 62 p, 14 fig, 9 tab, 4 ref, append.

Descriptors: *Biochemical oxygen demand, *Phosphorus, *Nitrogen, *Coliforms, *Dissolved oxygen, Estuaries, Algae, Water pollution sources, Water pollution effects, Water quality.
Identifiers: *Potomac River estuary.

For the first eight months of 1969, about 55% of the BOD entering the Potomac Estuary from all major sources was from waste water discharges in the Washington area. Also these discharges contributed 86% of the total phosphorus and 66% of the total nitrogen. Total carbon entering the estuary from all sources was mainly in the form of inorganic carbon. Dissolved oxygen levels were measured. As a result of increased chlorination of the waste water treatment facility effluents, coliform

densities were significantly lower. To facilitate the determination of waste water discharge loadings, the estuary was zoned into fifteen mile reaches. Maximum waste discharge loadings for BOD (organic carbon), nitrogen and phosphorus have been determined for Zone I in the Washington area. Preliminary estimates of loadings have been established for Zone II downstream from the Washington area. (Aalto-Chesapeake Technical Support Laboratory)
W71-05409

POTOMAC-PISCATAWAY DYE RELEASES AND WASTE WATER ASSIMILATION STUDIES,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
Norbert A. Jaworski, and James H. Johnson, Jr.
Special study conducted to evaluate effluent discharge effects in the Piscataway Creek tidal embayment. CTSL Technical Report No 19, MAR, FWQA, Dec 1969. 122 p, 54 fig, 27 tab, 8 ref, 3 append.

Descriptors: Water pollution effects, *Mathematical models, *Path of pollutants, Dye releases, Estuaries, Water pollution sources, *Waste assimulative capacity, Water quality.
Identifiers: *Piscataway Creek Embayment, *Potomac River estuary, Piscataway Waste water Treatment Plant.

Dye releases were made in the main channel of the Potomac Estuary and in the upper portion of the Piscataway embayment to simulate the movement of the effluents discharged from the Piscataway Waste Water Treatment Plant. Based on the data from the releases and the results from simulations by mathematical models of the upper Estuary and the Piscataway embayment it is concluded that the most advantageous waste water discharge location is on the main channel of the Potomac Estuary. (Aalto-Chesapeake Technical Support Laboratory)
W71-05410

UPPER POTOMAC RIVER BASIN WATER QUALITY ASSESSMENT,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
Johan A. Aalto, Leo J. Clark, and Norbert A. Jaworski.
Status report. CTSL Technical Report No 17, MAR, November 1969. 129 p, 33 fig, 34 tab, 8 ref, append.

Descriptors: Water pollution sources, Water pollution effects, *Coliforms, *E. Coli, *Biochemical oxygen demand, *Dissolved oxygen, *Mine drainage, *Thermal pollution, *Nutrients, Rivers, Water quality.
Identifiers: *Potomac River Basin.

Pollution conditions in the upper Potomac basin are investigated and their contributions to water quality problems of the Potomac Estuary are evaluated. Bacteriological data and coliform and fecal coliform densities are given. DO and BOD concentrations are examined. Water samples are analyzed for pesticide determinations. Major sources of thermal wastes are presented. The tributary streams producing most of the acid from mine drainage and major sources of nutrients are listed. (Aalto-Chesapeake Technical Support Laboratory)
W71-05411

CONTROL OF WATER POLLUTION FROM SOUTHWESTERN CATTLE FEEDLOTS,
Texas Tech Univ., Lubbock. Water Resources Research Center
For primary bibliographic entry see Field 05D.
W71-05412

ANIMAL WASTES - A NATIONAL PROBLEM,
Cornell Univ., Ithaca. Dept. of Agriculture, and Cornell Univ., Ithaca. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-05420

AGRICULTURE AND THE PREVENTION OF RIVER POLLUTION, AS EXPERIENCED IN THE WEST OF SCOTLAND,
Clyde River Purification Board (Scotland).
F. J. Little.
Journal Proceedings of the Institute of Sewage Purification, 1966, p 452-454. 1 tab, 7 ref.

Descriptors: *Farm wastes, *Water pollution sources, Effluents, Cattle, Poultry, Hogs, Sheep, Rivers, Silage, Biological treatment, Waste water treatment.
Identifiers: *Scotland, Dairy cattle, Silage liquor, Sheep dips, Remedial action, Extended aeration, Rivers (Scotland) Act 1951.

Different types of polluting effluents in Scotland are discussed, and what action has been taken to prevent river pollution. Agricultural effluents can be divided into three groups - animal, vegetable, and chemical, of which animal effluents pose the greatest problem. Dairy waste is the most prevalent effluent, while beef, sheep, hogs and poultry play a minor role. Biological treatment here is in the experimental stage. Silage liquor has presented a problem due to its high BOD. Chemical effluents result from the use of sheep dips, herbicides, fertilizers, bactericides, and dairy detergents. Problems arise from careless use of equipment rather than intentional discharges. The problems of disposal are complex and require the patience and understanding of both farmer and the general public. A discussion follows the paper. (White-Iowa State)
W71-05421

AGRICULTURAL PRACTICES AND WATER QUALITY.

Edited by T. L. Willrich and G. E. Smith, Iowa State University Press, Ames, 1970. 415 p.

Descriptors: *Farm wastes, *Water pollution sources, Waste water treatment, Aerobic conditions, Anaerobic conditions, Oxidation lagoons, *Path of pollutants, Waste disposal, Waste water disposal, Nutrients, Pesticides, Sediments, *Water quality.
Identifiers: *Agricultural pollution.

The chapters of this book are a result of a conference, The Role of Agriculture in Clean Water, held at Iowa State University, Ames, Iowa, November 18-20, 1969. Categories include: Sediment as a Water Pollutant, Plant Nutrients as Water Pollutants, Pesticides as Water Pollutants, Animal Wastes as Water Pollutants, Agricultural Pollution Implications, and Agriculture's Involvement in Polluted and Clean Water. (See also W71-05438 thru W71-05442)
W71-05437

LIVESTOCK OPERATIONS AND FIELD-SPREAD MANURE AS SOURCES OF POLLUTANTS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. R. Miner, and T. L. Willrich.
In: Agricultural Practices and Water Quality, 1970, Iowa State University Press, p 231-240. 2 tab, 25 ref.

Descriptors: *Pollutants, *Confinement pens, Farm wastes, Biochemical oxygen demand, Chemical oxygen demand, Runoff, Liquid wastes, Groundwater, Lagoons, Water pollution sources, Water pollution, Waste water treatment.
Identifiers: *Pollution characteristics, Lagoon effluent, Feedlot runoff.

This paper deals with the pollution potential from animal wastes. The pollution characteristics of animal wastes and the surface water and groundwater pollution potentials are discussed. Runoff is a primary mode of transportation of the waste to the water supplies. This pollution can be min through proper management. (See also 05437) (Christenbury-Iowa State)
W71-05438

MANURE DECOMPOSITION AND FAT BREAKDOWN PRODUCTS IN SOIL,
Department of Agriculture, Lincoln, Neb
Iowa State Univ., Ames.
T. M. McCalla, L. R. Frederick, and G. L. Pa
In: Agricultural Practices and Water Quality, Iowa State University Press, p 241-255. 2 tab, 38 ref.

Descriptors: Farm wastes, Disposal, Fert Aerobic conditions, Anaerobic cond Microorganisms, Storage, Water pollution so Waste water treatment.
Identifiers: Fertilizer value, Composition, down, Decomposition.

This paper discusses the composition of manure. Fresh manure contains from 30 t water. The rest of the constituents in manu inorganic and organic solids, liquids, and Manure contains all the inorganic nutrients r by plants. Roughly, 90% of the dry ma manure is organic waste material from digestion of feeds. The microbial populat animal waste is composed mainly of bacteria, actinomycetes, and protozoa. Significant d position of manure may occur in the feedlo lowed to remain there long enough. F decomposition occurs when applied to th Manure should be plowed under to minim loss. Huge quantities of animal waste applied land may result in accumulation of some c and inorganic constituents in concentration may become toxic to plants, particularly anaerobic decomposition conditions. (Se W71-05437) (Christenbury-Iowa State)
W71-05439

MANURE TRANSFORMATIONS AND FA DECOMPOSITION PRODUCTS IN WATE
Kansas Univ., Lawrence. Dept. of Civil Eng ing.
Ross E. McKinney.
In: Agricultural Practices and Water Quality, Iowa State University Press, p 256-264. 15 re

Descriptors: *Anaerobic conditions, *Aerob ditions, *Lagoons, Farm wastes, Odor, Ac solutions, Disposal, Microorganisms, criteria, Water pollution sources, Waste treatment.
Identifiers: Oxidation ditch, Anaerobic la Aerated lagoons, Oxidation ponds.

With regard to aqueous treatment syster animal manure, it is apparent that aqueous ment systems are not desirable for animal wa cept in special situations. The concentrated wastes are not normally mixed with water a be handled best as solid wastes. Chicken have been designed to handle the waste as However, confined hog houses have too muc manure for handling as solids. The oxidation has proven satisfactory for handling hog Treated hog manure must be returned to t for final disposal. The soil is the ultimate ac of all animal wastes. There is no reason that idation ditch should not be satisfactory for t cattle manure. The biological treatment will only a small fraction of the total solids manure. This treatment destroys the obn qualities and results in a material that is satisfactory for disposal. (See also W71-0 (Christenbury-Iowa State)
W71-05440

DISEASE TRANSMISSION OF WATER-B ORGANISMS OF ANIMAL ORIGIN,
Minnesota Univ., St. Paul. Dept. of Vete Microbiology and Public Health.
Stanley L. Diesch.

Agricultural Practices and Water Quality, 1970, va State University Press, p 265-285. 93 ref.

scriptors: *Diseases, *Animal diseases, *Animal thology, *Human diseases, Farm wastes, thogenic bacteria, Pathogenic fungi, Pathology, ruses, Water transfer, Human pathology, rasitism, Water pollution sources.
ntifiers: Disease transmission, Rickettsia.

effort is made to indicate the potential demiologic significance based on the variability the resistant characteristics of various kinds of thogenic organisms and their potential for water nsmission. The historical implication of water l disease is briefly reviewed. The current oblems of disease transmission related to water is cussed. To document water's role as a vehicle in ease transmission, information gathered from a rature review was used. Specific disease entities grouped by classification based on etiology of causative organisms. Infectious diseases of mals and man caused by bacteria, Rickettsia, uses, fungi, and parasitic organisms are cussed. (See also W71-05437) (Christenbury-va State)
71-05441

IMAL WASTE MANAGEMENT TO NIMIZE POLLUTION,
nnesota Univ., Minneapolis. Dept. of Agricul-al Engineering.
A. Moore.
Agricultural Practices and Water Quality, 1970, va State University Press, p 286-297. 35 ref.

scriptors: *Farm wastes, *Management, Aero- conditions, Anaerobic conditions, Disposal, rtiary treatment, Pollutants, Liquid wastes, goons, Sedimentation, Trickling filters, Water lution sources, Waste water treatment.
ntifiers: Flushing gutters, Composting, Aerated oons, Oxidation ponds, Slatted floors, Screen-

nagement of animal waste can be broken down o four separate functions: collection, storage, atment, and utilization or disposal. The options ilable for each of these functions are described. llection is divided into two types: wet or dry. The naining management functions depend on the llection type used. Three basic treatment ocesses developed by the Civil Service Engineers t apply to animal manure are described. These : Primary treatment, Secondary treatment, and rtiary treatment. Almost all of the utilization and posal of animal manures will be through land ap-cation. The disposal systems that have been ven are presented. These include liquid manure posal as well as solid manure disposal. (See also 71-05437) (Christenbury-Iowa State)
71-05442

RPTION AND DESORPTION OF LORINATED HYDROCARBON PESTICIDES CLAY MINERALS,
ssouri Univ., Rolla. Dept. of Civil Engineering.
eng Sun Liao.
Sc Thesis, 1969. 147 p, 44 fig, 34 tab, 67 ref, 4 pend. OWRR Project A-016-MO (2).

scriptors: *Pesticides, *Adsorption, *Clay nerals, Path of pollutants, Pesticide kinetics, T, Dieldrin, Heptachlor, Illite, Kaolinite, Mont-rillonite, Equilibrium, Chlorinated hydrocarbon ticides, Sorption, Aqueous solutions, Soil mistry.
ntifiers: *Pesticide adsorption (Clays).

e sorption and desorption of chlorinated lrocarbon pesticides by clay minerals were stu-d under laboratory controlled environmental tems. Particular emphasis was directed toward investigation of the fundamental adsorption nomena which occurred in selected pesticide-y systems. The effects of certain environmental sses, including pH, temperature and salt (NaCl) concentration of water, on the behavior of sorption and desorption were also studied. Pesticides selected for this study included DDT, dieldrin and heptachlor, and clay minerals employed were kaolinite, montmorillonite and illite. Chlorinated hydrocarbon pesticides were rapidly adsorbed by the experimental clay minerals; in most cases the adsorption equilibria were reached within two hours of reaction. After the pesticides had been adsorbed on the clays, desorption of the pesticides occurred only to a very small extent. The pH, temperature and salt (NaCl) concentration of water did not appear to exert significant effects. (Knapp-USGS)
W71-05447

DIGITAL SIMULATION MODEL OF INORGANIC WATER QUALITY OF TAHOE-TRUCKEE SYSTEM, NEVADA-CALIFORNIA, PROGRESS REPORT,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 05G.
W71-05469

A THERMAL PROFILE OF THE WATERS OF NEW YORK STATE.
New York State Atomic and Space Development Authority, New York; and New York State Dept. of Environmental Conservation, Albany.

Report of the New York State Atomic and Space Development Authority, 1970. 26 p, 1 tab, 5 fig, 32 images.

Descriptors: *Thermal pollution, *Powerplants, *Environmental engineering, *Water temperature, *Cooling, Infrared radiation, Remote sensing, Water pollution sources.
Identifiers: *New York.

Existing temperature patterns of New York State's major bodies of water were determined. Base line data on the extent and location of natural and artificial heat sources are provided. Large natural variations in water temperature caused by geographic location and seasonal variations were recorded along with the 'fine structure' of temperature influenced by flow, depth, tidal effects and mixing. Diffusion and dissipation patterns of man-made thermal discharges in various bodies of water were investigated. The survey was conducted in ponds, marshes, rivers, lakes and coastal waters. Airborne infrared sensing devices and data collection and recording equipment were used and reduced by computer to produce the thermal profiles. Results of the survey will be used for site selection for future nuclear powerplants and for predicting dissipation and dispersion of future thermal discharges along with better designs of outfall and cooling facilities for full protection of the environment. (Ensign-PAI)
W71-05503

DIFFUSION OF SEWAGE EFFLUENT FROM AN OCEAN OUTFALL,
Environmental Engineering, Inc., Gainesville, Fla.
R. H. Jones, and R. E. Stewart.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 99-108, 1970. 1 tab, 2 fig, 3 ref.

Descriptors: *Water pollution sources, *Outlets, *Sewage effluents, *Diffusion, Coliforms, Bacteria, Florida.
Identifiers: *Pompano Beach.

Diffusion investigations were carried out to estimate coliform bacteria concentration patterns of sewage effluent from an ocean outfall at Pompano Beach, Florida. The physical oceanography of the near-shore currents, turbulent diffusion of the sewage effluent, and natural die-off of the coliform bacteria were studied. A current meter array, current-cross observations, and fluorescein dye were used to determine the near-shore current patterns. The sewage-dye plume, after Rhodamin dye was injected, was tracked by a fluorimeter. Coliform bacteria die-off rates were determined which indicated that during the summer months the natural die-off is approximately two orders of magnitude greater than that during the winter. A model to assess future outfall installations was developed. (Ensign-PAI)
W71-05507

MANGANESE CONTENT AND THE OCCURRENCE OF FALLOUT 54MN IN SOME MARINE BENTHOS OF THE MEDITERRANEAN,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco); and Centre Scientifique de Monaco, Monte Carlo. Laboratoire de Radio-Activite Appliquee.
For primary bibliographic entry see Field 05C.
W71-05518

SEASONAL VARIATIONS IN INORGANIC PHYTOPLANKTON NUTRIENTS IN THE INSHORE WATERS OF CARDIGAN BAY,
University Coll. of Wales, Aberystwyth. Dept. of Botany.
J. B. Sykes, and A. D. Boney.
Journal of the Marine Biological Association of the United Kingdom, Vol 50, No 3, p 819-827, 1970. 2 fig, 2 tab, 24 ref.

Descriptors: *Water pollution sources, *Seasonal, *Phytoplankton, *Nutrients, Phosphates, Nitrates, Silicates.
Identifiers: Cardigan Bay, Wales.

Concentrations of inorganic phosphate, nitrate and reactive silicate were studied in the inshore waters of Cardigan Bay during 1967-68. The observed variations were largely due to phytoplankton activity and meteorological conditions. During the winter months all nutrients were at their peak and all showed minimum concentrations during the summer. Inorganic phosphate seemed to decrease when nitrate and silicate concentrations were high. River drainage and freshwater run-off, introducing various pollutants in the study area had a definite effect on the nutrient balance. (Ensign-PAI)
W71-05519

INSTRUMENT TO MEASURE WEAK SEA CURRENTS,
Ente Nazionale per l'Energia Eletrrica. Cellole (Italy). Laboratorio Ricerche Ambientali Garigliano.
G. Bartoli, G. Sandrelli, and G. Sorrentino.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 109-123, 1970. 3 fig, 4 ref.

Descriptors: *Currents, *Current meters, *Pollution abatement, *Diffusion, Instrumentation, Water pollution sources.
Identifiers: *Sea currents.

It is necessary in diffusion problems to measure sea currents of speeds less than the threshold of sensitivity of current meters normally used. A new instrument is described, where by abandoning all the mechanical systems which always have friction and exploit the cooling down of a hot thermistor which is suitably compensated for by the temperature variations of the water, a threshold of 0,3 cm/sec. can be reached. Direction measurement is obtained by a magnetic needle with optical finders and a rotating element with a double direction of rotation which registers position with a circular potentiometer. Measurement of a minimal movement in the direction of 3 degrees is possible. The maximum duration of the instrument is 5 days and can be used to a depth of 30 meters. (Ensign-PAI)
W71-05522

ON THE UNUSUAL PATTERNS OF PHOSPHATE VERTICAL DISTRIBUTION IN THE TAMAR ESTUARY,
Brussels Univ. (Belgium). Laboratoire de Botanique Systematique et d'Ecologie.

J. P. Mommaerts.
Journal of the Marine Biological Association of United Kingdom, Vol 50, No 3, p 849-855, 1970. 4 fig, 1 tab, 5 ref.

Descriptors: *Water pollution sources, *Phosphates, *Distribution patterns, *Estuaries.
Identifiers: Vertical distribution, *Tamar Estuary, Great Britain.

Anomalies in the vertical profile of phosphate concentration were revealed in a chemical investigation of the Tamar Estuary. These variations were not matched by that of salinity. Correlations between nitrogen and salinity and silicate and salinity were excellent. Biological activity and pollution as possible causes of this phenomenon are discussed. (Ensign-PAI)
W71-05525

THE FATE OF INTESTINAL BACTERIA IN THE SEA,
Harvard Univ., Cambridge. Div. of Engineering and Applied Physics.
Ralph Mitchell, and Morris J. Carrell.
Advances in Water Pollution Research, International Conference on Water Pollution Research, Fourth, Proceedings, Prague, Czechoslovakia, April 21-25, 1969, Pergamon Press, New York, p 811-821, 1969. 2 fig, 2 tab, 8 ref.

Descriptors: *Sewage, Sea water, *Self-purification, *Microorganisms, *Marine microorganisms, *Sewage bacteria, Water pollution sources, Waste disposal.
Identifiers: E. coli, Bdellovibrio, Pseudomonas, Nematodes.

Native marine microflora is active in the death of intestinal bacteria in the sea and the death rate increases with increase of the marine microbial population. Several groups of bacteria have been found to be associated with E. coli kill in sea water. Pseudomonas, causes death by enzymatically lysing the cell walls of the intestinal bacteria. Bdellovibrio, is parasitic and acts by actively parasitizing the coliforms and using the whole cell as a carbon source. Nematodes have also been found to prey on intestinal bacteria. It is likely that the significance of each group will vary temporarally and geographically depending on the ecoloigcal circumstances. There is reason to believe that the ecological principles that apply to the sea would also apply to other environments. (Ensign-PAI)
W71-05527

DISPERSION PHENOMENA IN COASTAL ENVIRONMENTS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources.
Klas Cederwall.
Boston Society of Civil Engineers, Journal, Vol 57, No 1, p 34-70, January 1970. 10 fig, 33 ref.

Descriptors: *Waste disposal, *Sewage, *Thermal pollution, *Dispersion, *Mathematical models, Site investigations, Water pollution sources, Environment.

Approaches for studying dispersion phenomena in coastal environments is discussed and applicable methodology is reviewed. Since mathematical models are widely used in hydrology for prototype simulation the principles for mathematical modeling of dispersion phenomena are presented. Advances in field measuring techniques as they apply to water pollution studies are reviewed. (Ensign-PAI)
W71-05528

NUMERICAL SIMULATION OF WATER QUALITY IN COASTAL WATERS AND ESTUARIES,
Rand Corp., Santa Monica, Calif.
J. J. Leendertse.
1970 IEEE International Conference on Engineering in the Ocean Environment, Panama City, Florida, September 21-24, 1970, Digest of Technical Papers, p 253-255. 2 ref.

Descriptors: *Estuaries, *Coasts, *Water quality, *Management, *Waste disposal, Dispersion, Tides, Flow, Model studies.
Identifiers: *Numerical simulation, *Fluid wastes.

Water quality management in coastal waters and estuaries must assess the effects of fluid wastes entering these waters. A model which computes the tidal flow and time-varying water levels in well mixed estuaries and coastal waters where salinity distributions at any point are uniform over the vertical was developed. The various composition of the fluid wastes can react with each other or with substances in the water so a reaction model was included. These reaction rates are influenced by water temperature and solar radiation. Wind and waves effect the exchange of gases at the water surface. Adjustment of the model using field measurements was necessary to establish the functional relationships. (Ensign-PAI)
W71-05539

THE USE OF RADIOISOTOPE TRACERS IN THE STUDY OF THE DISPERSION AND INACTIVATION OF BACTERIA DISCHARGED IN COASTAL WATERS,
Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Centre; Hadassah Medical School, Jerusalem (Israel); and Tel-Aviv District Public Health Lab. (Israel).
Chaim Gilat, H. I. Shuval, Y. Yoshpe-Purer, and Naftali Cohen.
Developments in Water Quality Research. Jerusalem International Conference on Water Quality and Pollution Research, Proceedings, Jerusalem Israel, June 1969, Tel Aviv, Ann Arbor Humphrey Science Publ, p 269-288, 1970. 8 fig, 9 ref.

Descriptors: *Radioisotopes, *Tracers, *Waste water disposal, *Bacteria, *Microorganisms, Water pollution sources.
Identifiers: Microbial dispersion, Microbial activation, Coastal waters.

The ever-increasing waste water disposal into coastal waters calls for the development of a realistic approach to define the influence of environmental factors which aid in dispersing and inactivating microbial pollutants. Data on rates of bacterial die-away in the Mediterranean is scant and very little data has been gathered on bacterial dispersion patterns on the shores of Israel. This investigation is an attempt at determining bacterial disappearance rates and dispersion patterns in situ by radioisotope tracer methods. Sewage outfall at Reading, north of Tel Aviv, was the site of these studies as it is representative of coastal conditions along Israel's southern Mediterranean shore. (Ensign-PAI)
W71-05545

THE DIFFUSION OF BACTERIAL POLLUTION IN THE SEA,
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
For primary bibliographic entry see Field 05C.
W71-05547

SURVEY AND PREDICTION OF POLLUTION IN THE OMUTA INDUSTRIAL HARBOUR,
Kyoto Univ. (Japan).
Shigehisa Iwai, Yoriteru Imoue, and Haruo Higuchi.
International Conference on Water Pollution Research, Fourth, Proceedings, Prague, Czechoslovakia, April 21-25, 1969, Pergamon Press, New York, p 883-899, 1969. 9 fig, 6 tab, 13 ref.

Descriptors: *Industrial wastes, *Dispersion, *Tracers, *Aerial photography, *Land reclamation, *Construction, Harbors, Coasts, Water pollution sources.
Identifiers: Survey, Predictions, Japan.

A new harbor is now under construction in Jap and is expected to be completed within three yea Coastal pollution is discussed for the period follo ing land reclamation and construction. Pro counter-measures should be planned now in or to prevent the expected increase in polluti Dispersion of pollutants near the shore can be qu accurately analysed by aerial photographs follo ing a cloud of tracer dye. The dispersion coe cients estimated from the photographs agreed w those based on concentrations of dye from act samples of the sea. The current and the dispers coefficients cannot be simulated at one time b series of model tests. The actual currents as th flow should be considered first and then the disp sion coefficients. The model gave lower dispers coefficients than the actual ones even after coefficients were corrected to allow for the scale the model. (Ensign-PAI)
W71-05548

TWELFTH CONFERENCE ON GREAT LAK RESEARCH,
Michigan Univ., Ann Arbor. Great Lakes Resea Div.; and Bureau of Commercial Fisheries, Ann A bor. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 02H.
W71-05561

TRANSPORT OF TRACE METALS TO THE A LANTIC OCEAN BY THREE SOUTHEASTE RIVERS,
Skidaway Inst. of Oceanography, Savannah, and Georgia Inst. of Tech. Atlanta.
H. L. Windom, K. C. Beck, and R. Smith.
Southeastern Geology, Vol 12, No 3, p 169-1 January 1971. 13 p, 6 fig, 4 tab, 14 ref.

Descriptors: *Trace elements, *Dissolved soli *Streamflow, *Sea water, *Estuaries, Chemi precipitation, Runoff, Sediment yield, Wa chemistry, Bottom sediments, Atlantic Oce Geochemistry, Oceanography, Solutes, Suspend load.
Identifiers: Trace metal transport, Ocean chem try.

Composition of trace metals in solution in estuar of three Southeastern rivers are similar. Dissolv iron and possibly manganese decrease in conce tration going from fresh to saline waters owing precipitation. The composition of trace metals suspended sediment from the estuaries of the th rivers differs, suggesting a relationship to the co position of the respective drainage basin. The to amount of trace metals transported to the Atlan in both solution and suspension by these rivers a pears to be insufficient to supply more than abo 100 sq km of average Atlantic deep sea sedime River runoff appears to be inadequate to expla the trace metal accumulation of North Atlan deep-sea sediments. (Knapp-USGS)
W71-05579

RHINE RIVER POLLUTION STUDIES,
Cornelius Biemond.
Journal American Water Works Association, V 63, No 1, p 36-40, January 1971. 5 p, 3 fig, 3 tab ref.

Descriptors: *Water pollution sources, *Water p lution control, *Surveys, *Rivers, Industrial wast Mine wastes, Sewage, Oily water, Dissolved o ygen, Nutrients.
Identifiers: *Rhine River.

As for all rivers of highly developed areas, the p lution of the Rhine has become a serious proble The countries concerned (Switzerland, Franc Western Germany, Luxemburg and The Neth lands) have agreed to the initiation and continu tion of the International Commission for the Pr tection of the Rhine against Pollution. The powe of the commission are limited to collaboration research and investigations and to the unanimo

rmulation of proposals to the governments. For
pollution problems, the periods of low flow are
critical ones. They usually occur around the
nth of October, when snowmelt in Switzerland
s ceased and autumn rains in the remainder of
basin are delayed. Most of the sewage from
vns and industries is discharged untreated or
y mechanically treated. Apart from domestic
l industrial sewage, there is a continuous
charge of mineral matter by mines and indus-
es, which has led to an increasing load of dis-
ved minerals. (Knapp-USGS)
1-05581

**DISCUSSION OF THE CHEMICAL
ARACTER OF WATER MIXTURES,**
lifornia Univ., Berkeley. Dept. of Chemistry.
Rhodes Trussell, and Jerome F. Thomas.
rnal of American Water Works Association,
l 63, No 1, p 49-51, January 1971. 3 p, 6 fig, 6
, 7 ref.

scriptors: *Mixing, *Water chemistry,
ydrogen ion concentration, Water quality,
uilibrium, Carbon dioxide, Carbonates, Alkalini-
Calcium carbonate, Computer programs.
ntifiers: *Buffering.

potable water is usually a blend from several
rces, it is necessary to predict the chemical
aracteristics of various mixtures. In addition,
blems of mixing have been encountered in deep
l injection at the interface between the receiv-
water and the water being injected. The
drogen-ion concentration of the water is primari-
governed by the CO2 buffer system. The bicar-
nate equilibria are used to predict pH. A general
ation of simple form governing the CO2 buffer-
system is presented. A short computer program
utlined to use this equation to simulate the mix-
of waters, and some results are illustrated. (K-
p-USGS)
1-05582

**OSPHATE MOVEMENT IN SURFACE RUN-
F WATER,**
nistry of Works, Nelson (New Zealand). Mou-
Soil Conservation Station.
N. Gilchrist, and A. G. Gillingham.
w Zealand Journal of Agricultural Research,
13, p 225-231, 1970. 2 fig, 3 tab, 8 ref.

scriptors: *Phosphate, *Surface run-off, *Rain-
, *Fertilizers, Path of pollutants, Nutrients.
ntifiers: New Zealand.

ense simulated rainfall was applied to small plots
dressed in strips with aerial superphosphate at 4
per acre to determine how much and, within
limits of the apparatus, how far the water-solu-
fraction could be moved down slope in surface
-off water. It was found that 3 in. of rainfall (2
of run-off) in 1 hr could remove 28% of the fer-
er placed in a 3 in. wide band at a distance of 2-
- 2-1/2 ft up slope from a collecting tray. (Lit-
Battelle)
1-05625

**DIMENT-WATER NUTRIENT RELATION-
IPS - PARTS 1 AND 2,**
deral Water Quality Administration, Cincinnati.
ld Investigations Branch.
rald D. McKee, Loys P. Parrish, Carl R. Hirth,
nneth M. Mackenthum, and Lowell E. Leup.
ter and Sewage Works, Vol 117, No 6, p 203-
, June 1970. 23 ref; No 7, p 246-250, July 1970.
g, 27 ref.

scriptors: *Nutrients, *Sediments, *Water anal-
, Lake Morphology, Sedimentation, Plankton,
l migration, Protozoa, Hydrogen ion concentra-
, Water temperature, Bacteria, Algae, Alkalini-
iron, Phosphate, Phosphorus, Carbon, Nitrogen,
rrents (Water), Winds, Nevada, California, New
rk, Oregon, Wisconsin, Maine.
Identifiers: Fecal material, Lake Tahoe, Lake Sebasticook (Maine), Fayetteville Green Lake (New York), Upper Klamath Lake (Oregon), Lake Mendota (Wisconsin).

A thorough review of the mechanisms of nutrient deposition and exchange in aquatic environments led to the following conclusions: (1) A portion of the nutrients, soluble and insoluble, in a water body are ultimately destined to become part of the sediments. (2) Organisms are primary concentrators of dissolved nutrients. (3) The initial areas of deposition may be only temporary, the nutrient-containing sediments may be re-dissolved or may be physically transported. (4) Wind-induced currents are a major factor that determines the rate and area of final deposition and the contact time between suspended sediments and water. (5) Morphology of the water body affects the ultimate area of deposition. (6) Aquatic organisms convert inorganic nutrients to organic nutrients and vice versa. (7) Suspension of sediments increases their effect on the overlying water. (8) The sediments act as reservoirs of nutrients for the overlying water. (9) The rapidity of sediment build-up will affect the degree of influence on the overlying water. (Little-Battelle)
W71-05626

RESIDUES IN FISH, WILDLIFE AND ESTUARIES,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Center for Estuarine and Menhaden Research.
David J. Hansen, and Alfred J. Wilson, Jr.
Pesticides Monitoring Journal, Vol 4, No 2, p 51-56, September 1970. 1 fig, 2 tab, 6 ref.

Descriptors: *DDT, *Perches, *Water pollution effects, Dieldrin, Endrin, Florida, Estuaries, Oysters, Gas chromatography, Migration, Wildlife.
Identifiers: *Pinfish, Sample preservation, Pigfish, Atlantic croaker, Spot, Thin-layer chromatography, Metabolites, DDD, DDE.

Pesticide residues in fishes from the estuary near Pensacola, Fla., monitored from April 1964 to November 1965, are compared with residues in fishes exposed to DDT in the laboratory. DDT in fish exposed to 0.1 ppb p,p'-DDT for 5 weeks failed to increase after the second week, when maximum concentrations reached 38,000 times that in the test water. Loss of DDT from these fish was slow, 78%-87% in 8 weeks. The amounts of DDD or DDE in fish did not increase either during or after exposure. (Little-Battelle)
W71-05643

THE COURSE OF BIODEGRADATION OF ANIONIC DETERGENTS BY ANALYSES FOR CARBON, METHYLENE BLUE ACTIVE SUBSTANCE AND SULFATE ION,
Department of Agriculture, Philadelphia, Pa. Eastern Utilization Research and Development Div.
T. C. Cardon, E. W. Maurer, and A. J. Stirton.
Journal of the American Oil Chemists' Society, Vol 47, No 6, p 203-206, June 1970. 7 fig, 1 tab, 7 ref.

Descriptors: *Alcohol, *Sodium sulfates, Biodegradation, Carbon, Detergents, Turbidity, Microorganisms, *Linear alkylate sulfonates.
Identifiers: *Methylene blue active substance, *Sulfate ion, Glucose, Esso research test, Auto analyzer.

The results are presented of an investigation of the metabolism of tallow-based detergents and a mechanism of their breakdown by sewage microorganisms under aerobic conditions. The detergents were tallow alcohol sulfates, ether alcohol sulfates, and esters of a-sulfo fatty acids. Other compounds were included to help relate structure to ease of biodegradation. The individual isomer sodium p-(1-methylundecyl) benzenesulfonate (LAS) was used as a reference standard. Since biodegradation was followed by loss of carbon and methylene blue active substance (MBAS) and formation of sulfate ions, the Esso research test was employed as a basis for a method for the measurement of these subfactors. Tallow alcohol sulfates were rapidly and completely degraded; ether alcohol sulfates not quite so rapidly. Reduction in MBAS was rapid for the a-sulfo esters, but loss of carbon and formation of sulfate ion were incomplete, possibly because of the intermediate formation of a resistent sulfosuccinate. Figures show the rates of biodegradation of various alcohol sulfates and fatty acids as determined by carbon loss, MBAS reduction, and formation of sulfate ions. (McCann-Battelle)
W71-05653

GROUNDWATER POLLUTION,
Michigan Dept. of Public Health, Lansing Section of Water Supply.
Donald K. Keech.
Typescript, 1970. 20 p.

Descriptors: *Water pollution, *Groundwater, *Path of pollutants, *Pollutant identification, *Michigan toxins, Soil contamination, Wastes, Water pollution control, Water pollution effects, Water pollution sources, Natural gas, Gasoline, Calcium chloride, Aquatic bacteria, Waste disposal, Detergents, Michigan.
Identifiers: *Chemical contamination, Salt, Brine, Natural gas erruptions.

The purpose of this paper is to show, mainly by example, how the valuable groundwater resource has been contaminated, primarily through negligent practices. Pollution of groundwater results in degradation of the water quality in one of three categories: Micro-biological, chemical, and physical. Case histories of various contaminations within the State of Michigan are explored. The report is well documented and well illustrated. It stresses concern over possible problems than can cause irreversible damage to the valuable groundwater resource. (Campbell-NWWA)
W71-05693

RURAL RUNOFF AS A FACTOR IN STREAM POLLUTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
R. B. Weidner, A. G. Christianson, S. R. Weibel, and G. G. Robeck.
Journal Water Pollution Control Federation, Vol 41, No 3, p 377-384, March 1969. 10 tab, 6 fig, 3 ref.

Descriptors: *Surface runoff, *Water pollution, Farm wastes, Storm runoff, Water quality, Acreage, Cultivated lands, Grasslands, Pastures, Forests, Urbanization, Land use, Nitrogen, Phosphorus, Soil erosion, Watersheds, Physical characteristics, Slopes, Fertilizers, Pesticides, Mulching, Flow measurement, Sampling, Flumes, Coliforms, Precipitation, Rainfall intensity, Time, Corn, Regression analysis, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: Soil characteristics, Measuring flume.

The results of this work indicate that rural runoff is a factor in stream pollution and that it must be considered when one evaluates the quality of any stream or receiving body of water. However, there also must be an awareness that there are some means available for reducing this pollutional load. This study showed that, despite an increase in the amount of fertilizers and manure applied under improved practices, there was a marked decrease in the amount of pollutional load that came from these watersheds as contrasted to the load from watersheds using prevailing practices. Runoff, soil loss, and microbial densities were considered. (White-Iowa State)
W71-05746

ORIGINS AND NATURE OF FARM WASTES,
National Agricultural Advisory Service, London (England).
K. B. C. Jones, and C. T. Riley.

Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne, Paper No 1, p 7-14, 1970. 9 tab.

Descriptors: *Farm wastes, *Disposal, Rain water, Costs, Cattle, Hogs, Poultry, Planning, Legislation, Legal aspects, Economics, *Waste disposal.
Identifiers: *United Kingdom, Washing-down water, Nature of waste, Population equivalents, Origins of waste.

Waste disposal is discussed in relation to population expansion, diminishing acres, declining numbers of agriculture workers, economic pressures, limited natural water resources, and legal pressures. The origin and nature of the wastes that must be disposed of is discussed. The trends in planning and disposal patterns taking place were considered. The costs associated with disposal were examined in relation to the income produced. Food processing waste has created some disposal problems for farmers. The disposal problems created by fruit and meat processing are discussed in the last portion of the paper. (See also W71-05747). (Christenbury-Iowa State)
W71-05748

ORIGINS AND NATURE OF FARM WASTES: DISCUSSION,
Gowan, Douglas.
Douglas Gowan.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne, Paper No 2, p 15-18, 1970. 1 tab.

Descriptors: Farm wastes, Disposal, Legislation, Discharge (Water), Sewers.
Identifiers: River authorities, Extensive farmer, Intensive farmer, United Kingdom, Public sewers.

Disposal of farm waste has become a major problem. A wholehearted effort is needed to deal with the problem, involving men, laboratories, and money. Also the farmers themselves must lend practical assistance. The law is there, and social and economic pressures are unlikely to ease. Nor is farming going to become less intensive, when this is the only way to profit, and the increasing public demand for food exists. All must combine to make sure that our inherent desire for increased water resources and pleasant-looking and smelling countryside facilities are one day realized. (See also W71-05747). (Christenbury-Iowa State)
W71-05749

TURBULENT MIXING IN SUBMERGED TWO-DIMENSIONAL WALL JETS,
Tennessee Univ., Knoxville. Dept. of Engineering Mechanics.
For primary bibliographic entry see Field 08B.
W71-05767

RECOVERY, SEPARATION, AND IDENTIFICATION OF PHENOLIC COMPOUNDS FROM POLLUTED WATERS,
Rutgers - The State Univ., New Brunswick, N. J. Dept of Environmental Sciences.
For primary bibliographic entry see Field 05A.
W71-05768

WATER-QUALITY STUDIES ON THE KALAMAZOO RIVER,
Michigan State Univ., East Lansing. Inst. of Water Research.
Allen W. Knight, and George H. Lauff.
Institute of Water Research, Technical Report No 5, Michigan State University, East Lansing, Michigan, September 1969. 61 p, 10 fig, 17 tab.

Descriptors: *Water quality, Self-purification, *Pollution abatement, Environment, Ecology, Water pollution control, Water pollution sources.
Identifiers: Environmental problems, Macroinvertebrates.

The Kalamazoo River was studied to ascertain conditions just prior to a pollution-abatement program. The river was found grossly polluted in a twenty-mile stretch below the City of Kalamazoo. The decomposition of organic matter in the water and in extensive silt accumulations frequently depleted the dissolved oxygen for twenty miles or more below Kalamazoo. Sewage fungus covered the surface of the sludge deposits and stationary objects in the water, while extensive numbers of sludge worms frequently occurred as an enormous red fringe along the river margins. Only a few of the more tolerant macroinvertebrates and fish occurred in the very polluted zone. In the lower reaches of the river, considerable self-purification was accomplished, accompanied by a return of many of the Macroinvertebrates and game fish. Prior to its discharge, the river accomplished considerable self-purification but still carried a large load of suspended and dissolved materials into Lake Michigan. (Wray-Chicago)
W71-05774

BACKGROUND PAPERS ON COASTAL WASTES MANAGEMENT.
National Academy of Sciences-National Research Council, Washington, D.C. Committee of Oceanography; and National Academy of Engineering, Washington, D.C. Committee on Ocean Engineering.

Prepared for Coastal Wastes Management Study Session held at Jackson Hole, Wyo. 6-12 July 1969. Available from NTIS as PB-198 032, $6.00 paper copy, $0.95 in microfiche. Washington, DC, Vol I, 1969. 391 p. FWQA Program 16060 DUF 07/69.

Descriptors: Water pollution sources, *Water pollution control, Wastes, *Pollutant identification, *Coasts, Water pollution effects, Estuaries.
Identifiers: Coastal wastes.

This collection of background papers in coastal wastes management is a supplement to the NAS-NAE report, 'Wastes Management Concepts for the Coastal Zone Requirements for Research and Investigation.' (See W71-01544). The report itself was prepared under the auspices of the Committee on Oceanography of the National Academy of Sciences (NASCO) and the Committee on Ocean Engineering of the National Academy of Engineering (NAECOE). The study session was convened for the purpose of reviewing the state-of-the-art and knowledge concerning the disposal of wastes in the coastal environment, and identifying the areas in which expansion of scientific and engineering knowledge is required for rational evaluation of waste management problems in the coastal zone. (See also W71-05788 thru W71-05803)
W71-05787

EVALUATION OF SOURCES AND CHARACTERISTICS OF WASTE DISCHARGES,
Los Angeles Bureau of Sanitation, Calif.
Robert D. Borgman, and John D. Parkhurst.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p II-117.

Descriptors: *Wastes, *Water pollution sources, *Human population, *Ecology, *Pollutants, Farm wastes, Mine wastes, Municipal wastes, Solid wastes, Radioactive wastes, Chemical wastes.

Waste discharges as they affect the littoral region of U.S. coasts are evaluated. Agricultural and mining wastes make up 2.3 billion tons per year. Air pollution discharges, liquid and solid municipal wastes and automobile bodies contribute 507 million tons per year to these areas. The composition, decomposition and treatment of known wastes along with the standard methods of sampling, monitoring and analysis are discussed. The speculative unknown waste discharges are discussed and the need for systematic summation and integration of the known wastes are considered. (See also W71-05787) (Ensign-PAI)
W71-05788

MONITORING OF THE MARINE ENVIRO MENT FOR WASTE COMPONENTS AND FO EFFECTS OF THE INTRODUCED WASTES,
Texas A and M Univ., College Station. Dept. Civil Engineering.
For primary bibliographic entry see Field 05A.
W71-05789

NEW YORK CITY - A MAJOR SOURCE MARINE SEDIMENT,
State Univ. of New York, Stony Brook. Mari Sciences Research Center.
M. Grant Gross.
Background Papers on Coastal Wastes Manag ment, prepared for National Academy of Scienc Committee on Oceanography and the Natio Academy of Engineering Committee on Ocean E gineering, Wash, DC, Vol 1, 1969, p III 1-III 24 fig, 7 tab, 11 ref.

Descriptors: *Water pollution sources, *So wastes, *Sediment, Dredging, Constructio Human population.
Identifiers: New York City.

The largest single source of sediment enteri directly into the Atlantic Ocean from North Am ica consists of 8.6 million tons per year of so waste dumped into Western Long Island Sou Dredging, construction and demolition wastes the metropolitan region were dumped in are where little modern sediment had accumulate The average annual discharge for the New Yo metropolitan region was estimated at 0.75 tons p person. Data on the physical properties of the wastes, volumes from various sources a discharge rates are presented. Rates for natu river sediment discharge is given for compariso (See also W71-05787) (Ensign-PAI)
W71-05790

WASTE DISCHARGE MONITORING,
California Univ., Berkeley. Div. of Hydraulic a Sanitary Engineering.
For primary bibliographic entry see Field 05A.
W71-05791

PHYSICAL PROCESSES IN COASTAL AREAS
Johns Hopkins Univ., Baltimore, Md. Chesapea Bay Inst.
Harry H. Carter.
Background Papers on Coastal Wastes Manag ment, prepared for National Academy of Scienc Committee on Oceanography and the Natio Academy of Engineering Committee on Ocean E gineering, Wash, DC, Vol 1, 1969, p V 1-V 16 fig, 3 tab, 8 ref.

Descriptors: *Coasts, *Wastes, *Water polluti sources, *Distribution, *Advection, *Diffusion.
Identifiers: *Removal processes, Geologi processes, Biological processes, Chemi processes, Floatables, Sinkables.

Waste management in the coastal zone is basica determination of the capacity to receive was without undesirable effects on the environment. determine this capacity the distrubtion of t sources, the physical processes of advection a diffusion and the geological, biological and chem cal processes of removal are considered. Adequa of existing knowledge as a foundation for pred tion and the proposed objectives for gaining furth knowledge are discussed and presented in order priority. (See also W71-05787) (Ensign-PAI)
W71-05792

PHYSICAL PROCESSES WHICH INTERAC WITH AND INFLUENCE THE DISTRIBUTIO OF WASTES INTRODUCED INTO TH MARINE ENVIRONMENT,
Johns Hopkins Univ., Baltimore, Md. Chesapea Bay Inst.
Akira Okubo.

ckground Papers on Coastal Wastes Manage-
nt, prepared for National Academy of Sciences
mmittee on Oceanography and the National
ademy of Engineering Committee on Ocean En-
eering, Wash, DC, Vol 1, 1969, p VI 1-VI 38. 5
22 ref.

scriptors: *Estuaries, *Wastes, *Pollutants,
istribution, *Water circulation, *Movement,
ffusion, *Mixing.
ntifiers: Hydraulic models, Mathematical equa-
ns.

e distribution of wastes and the physical
cesses which influence and interact with these
tes in estuaries and tributary embayments are
cussed. The various types of circulation patterns
presented with the description and basic equa-
ns of the processes which produce the dispersion
waste materials. Details of the investigation of
ting knowledge, as a frame of reference for pol-
on prediction, and the need for further in-
igation of eddy-fluxes, shear effect, entrapment
nomenon and the use of hydraulic models are
sidered. (See also W71-05787) (Ensign-PAI)
1-05793

**PERSION OF NON-CONSERVATIVE
STES DISCHARGED INTO THE OCEAN,**
ola Univ., Los Angeles, Calif.
es E. Foxworthy.
kground Papers on Coastal Wastes Manage-
t, prepared for National Academy of Sciences
mmittee on Oceanography and the National
demy of Engineering Committee on Ocean En-
ering, Wash, DC, Vol 1, 1969, p VII 1-VII 21. 3
27 ref.

criptors: *Wastes, *Dispersion, *Diffusion,
aste dilution, *Bacteria, *Indicators,
liforms, Mortality, Mathematical models.

he design of waste disposal facilities it is neces-
to provide more efficient outfall systems and
er waste treatment. In answer to these needs
ersion of non-conservative material has been
stigated and the findings and recommendations
further study are presented. Mathematical
els used to quantify the dispersion charac-
tics and estimation of the magnitude of the dif-
on parameters and initial plume size, in order to
y these model equations, are discussed. Both
zontal and vertical diffusion in the ocean are
uded. Empirical relationships in estimating
tion of oceanic waste plumes are demonstrated
the significance of source size on the predicted
s of dilution is pointed out. Physical dilution
coliform mortality is demonstrated by the
lts of a field experiment. (See also W71-
87) (Ensign-PAI)
-05794

**SICAL EFFECTS ON RECEIVING
TERS,**
ornia Univ., Berkeley. Dept. of Civil Engineer-

primary bibliographic entry see Field 05C.
-05795

**EMICAL AND GEOCHEMICAL EFFECTS
RECEIVING WATER,**
ka Univ., College. Inst. of Marine Sciences.
primary bibliographic entry see Field 05C.
-05796

**EMICAL AND GEOCHEMICAL PROCESSES
CH INTERACT WITH AND INFLUENCE
DISTRIBUTION OF WASTES IN-
DUCED INTO THE MARINE ENVIRON-
T, AND CHEMICAL AND GEOCHEMICAL
ECTS ON THE RECEIVING WATERS,**
ornia Inst. of Tech., Pasadena; and Pomeroy,
ston, and Bailey, Pasadena, Calif.
es J. Morgan, and Richard D. Pomeroy.
ground Papers on Coastal Wastes Manage-
, prepared for National Academy of Sciences
Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p X 1-X 44. 1 fig, 8 tab, 20 ref.

Descriptors: *Wastes, *Water pollution sources, *Chemical analysis, *Geochemistry, *Trace elements, Absorption, Precipitation, Oxidation-reduction potential, Organic compounds, Carbon, Metals, Organic matter, Radioisotopes, Surfactants.

Concentrations of minor constituents in the ocean, and the forms they take: metallic elements, nitrogen, phosphorus, silica, and living and non-living organic matter are reviewed. The physical-chemical processes regulating the composition of the oceans such as reactivity and mass balance of elements added to the sea, adsorption-desorption reactions of trace metals, precipitation-dissolution reactions, oxidation and reduction processes and biological concentrations are described. Organic carbon in the oceans, cycling between sea-land and sea-atmosphere, and the metal organic complexes in sea water are also discussed. The changes caused by man's activities and the effect of changed rates of element additions to the oceans along with additions of unnatural substances by rivers, industrial and domestic wastes, outfalls, shipping, mining, and fallout are considered. (See also W71-05787) (Ensign-PAI)
W71-05797

SOME CHEMICAL AND GEOCHEMICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Oceanography.
Francis A. Richards.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p XI 1-XI 25. 2 tab, 27 ref.

Descriptors: *Wastes, *Environment, *Chemical analysis, *Geochemistry, *Distribution, Oxidation-reduction potential, Precipitation, Chemical reactions, Flocculation, Aggregates, Sorption.
Identifiers: Complexation.

The inorganic chemical and geochemical reactions that take place when foreign materials are introduced into the ocean are discussed with emphasis on the non-life processes. The kinds of processes that can take place, a review of present knowledge of these processes and suggestions for future research on how these processes are concerned in coastal waters management are presented. Included in these processes are changes in phase, oxidation state, ionic or molecular speciation, and chemical activity caused by any process which changes temperature, pressure, ionic strength, or composition. Specifically, processes of acid-base reactions, redox reactions, complexation, ion exchange reactions, sorption, precipitation, flocculation and aggregation are covered. It is pointed out that toxic and non-toxic wastes should have quite different chemical and geochemical consequences. (See also W71-05787) (Ensign-PAI)
W71-05798

BIOLOGICAL EFFECTS OF WASTE DISCHARGES ON COASTAL RECEIVING WATERS,
Engineering-Science, Inc, Forest Hills, N.Y.; and Engineering-Science, Inc., Arcadia, Calif.
For primary bibliographic entry see Field 05C.
W71-05799

BIOLOGICAL EFFECTS ON RECEIVING WATERS,
Maryland Univ., Solomons. Natural Resources Inst.
For primary bibliographic entry see Field 05C.
W71-05800

BIOLOGICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.
Loren D. Jensen.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p XIV 1-XIV 9. 6 ref.

Descriptors: *Wastes, *Environment, *Distribution, *Biology, Organic compounds, Inorganic compounds, Bacteria, Biodegradation.

Living organisms inhabiting surface waters are adapted to dilute solutions of inorganic salts, atmospheric gases and extracted organic materials. Due to the volumes involved and the dilute nature of the waste streams and coastal waters the physical, chemical and biological processes that occur when such solutions mix are considered. The main biological processes which are involved with waste stabilization are bacterial fermentation which occur on wetted surfaces. The exploitation of these processes is the primary mechanism of waste stabilization with conventional biological waste treatment systems. These biological processes which interact with and influence the distribution of wastes are discussed in detail. See also W71-05787) (Ensign-PAI)
W71-05801

THE COASTAL POLLUTION PROBLEM IN CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, Calif.
John A. McGowan.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p XV 1-XV 3.

Descriptors: *Waste disposal, *Oceans, *Water pollution control.
Identifiers: *California, Tolerable waste limits, Pollution study grants, Regional planning, Basic research, Sampling, Monitoring.

A three month study of the literature on coastal waste disposal in California indicates that the magnitude of coastal pollution has not yet reached that of the state's fresh waters and estuaries but they are definitely in the incipient stages of such magnitude. The many sewage outfalls are greatly influencing the ecology of the coastal zone. Particulate organic detritus deposits in the area of outfalls seem to be increasing and it is doubtful an equilibrium will be reached. More of these outfalls are being planned and since coastal waters do not mix perfectly the outlook for coastal ecology is not good. Proposals for tolerable limits; pollution studies grant proposals; development of ecological, biochemical and physiological indices; and regional planning for research laboratories and waste disposal systems are set forth. (See also W71-05787) (Ensign-PAI)
W71-05802

BIOLOGICAL EFFECTS ON RECEIVING WATERS: THE PLANKTON,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 05C.
W71-05803

5C. Effects of Pollution

SLUDGE DUMPING IN THE THAMES ESTUARY,
Ministry of Agriculture, Fisheries and Foods, Burnham-on-Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 05B.
W71-05342

MARINE POLLUTION PROBLEMS IN JAMAICA,
University of the West Indies, Kingston (Jamaica). Dept. of Zoology.
For primary bibliographic entry see Field 05B.
W71-05349

MODELING OF THE NITROGEN AND ALGAL CYCLES IN ESTUARIES,
Manhattan Coll., Bronx, N.Y. Environmental Engineering and Science Program.
For primary bibliographic entry see Field 02L.
W71-05390

PHOSPHATE DISTRIBUTION IN FOX AND WOLF RIVERS, WISCONSIN,
Aamund Salveson.
Water and Sewage Works, p 142-152, May 1970. 4 fig, 15 ref.

Descriptors: *Phosphates, *Water pollution sources, *Sampling, Rivers, Fish kills, Biodegradation, Fertilizers, Municipal wastes, Wisconsin.
Identifiers: *Fox River (Wis), *Wolf River (Wis), Poly-phosphates, Ortho-phosphates.

Analyses of the surface water samples of the two rivers included determinations of soluble orthophosphate, total and polyphosphates, pH value, filterable residue, and temperature. The Wolf River showed relatively low contents of total and orthophosphates, except in the Markton, New London, and Freemont sections, influenced by discharge of sewage or by fertilizer-enriched runoff. In spite of the abundance of algae and fish kills, filtered water of Lake Poygan was very low in phosphates suggesting their intensive fixation by phytoplankton. The Upper Fox River showed an extremely high concentration of phosphates (1.30 to 1.50 mg/l of phosphorus tetraoxide) near Fort Winnebago and the sewage outlet of the town Portage. The section from Montello to Omro preserved a rather high concentration of the total phosphates, but contained very small amount of orthophosphates (below 0.10 mg/l). The Fox River from Neenah to Green Bay exhibited only small variation in moderately high contents of both forms of phosphorus. (Wilde-Wisconsin)
W71-05392

LAKES: THE VALUE OF RECENT RESEARCH TO MEASURE EUTROPHICATION AND TO INDICATE POSSIBLE CAUSES,
Marine Dept., Rotorua (New Zealand). Fisheries Research Division.
For primary bibliographic entry see Field 05B.
W71-05401

EFFECTS OF DOMESTIC SEWAGE ON AQUATIC INSECTS AND SALMONIDS OF THE EAST GALLATIN RIVER, MONTANA,
Montana Cooperative Fishery Unit, Bozeman.
E. L. Avery.
Water Research, Vol 4, p 165-177, 1970. 2 fig, 7 tab, 17 ref.

Descriptors: *Rivers, *Water pollution effects, *Municipal wastes, Trout, Aquatic insects, Salmonids, Diptera, Montana.
Identifiers: *East Gallatin River (Mont), Sphacrotilus, Trichoptera, Ephemeroptera, Coleoptera, Plecoptera.

Sampling of aquatic insects and salmonids at the Bozeman municipal sewage outfall disclosed a depressing effect on the density of Trichoptera, Ephemeroptera, Coleoptera, and Plecoptera larvae. This effect was related to the occurrence of 'sewage fungus,' Sphaerotilus sp. A partial recovery of the insect community was observed at 3.85 miles below the outfall. At about 12.5 miles below the discharge, the fertilizing influence of diluted sewage raised the number of aquatic insects about 13 times above the normal. Rainbow, brown, and brook trout and mountain whitefish were found above the outfall, but only rainbow trout were present below the discharge beginning with the point where complete mixing of the sewage had occurred. The winter increase in ammonia nitrogen below the discharge reduced the standing crop of the trout. (Wilde-Wisconsin)
W71-05402

SOME EFFECTS OF TEMPERATURE ON SURVIVAL AND METABOLISM OF SELECTED ESTUARINE BIVALVES,
Rhode Island Univ., Kingston. Dept. of Zoology.
Victor S. Kennedy.
PhD thesis, 1970. 153 p, 26 fig, 22 tab, 48 ref, Append A, B, C, D, E. OWRR Projects A-002-MD (6) and A-011-MD (1).

Descriptors: *Metabolism, *Estuaries, *Clams, Water pollution effects, Maryland, Temperature, Respiration, Size, Weight, Acclimatization, Thermal water, Distribution, Latitudinal studies, Geographical regions, Benthos, Spawning, Salinity, Age, Computer programs.
Identifiers: *Bivalves, Compensatory adaptation, Patuxent Estuary (Md), Mya arenaria, Macoma balthica, Macoma phenax, Mulinia lateralis, Gemma gemma.

Significance of thermal discharge into the environment led to a study of Mya arenaria, Macoma balthica, Mulinia lateralis, Gemma gemma, and Macoma phenax, determining upper lethal temperatures. Sensitivity to slight temperature differences, probably reflected real physiological differences. Young Mya arenaria and Macoma balthica were more high-temperature tolerant than older clams of same species. Their vertical benthic distribution may be significant with relation to age and species differences. When Mya are killed by high temperatures, the more resistant Gemma may occupy the space. Resettlement of Mya would be prevented by larval Mya-adult Gemma competition. Spawning patterns of Mya and Macoma balthica in summer in Chesapeake Bay benthos could be affected by thermal discharge eliminating Mya and influencing interactions of Mya-Gemma. Respiration rate of Macoma balthica, Mulinia lateralis and Mya arenaria decreased with increasing size, and varied directly with temperature. Cold-acclimated Mulinia and Mya were metabolically depressed by high temperatures (30C), and low temperatures (1-2C) depressed or disrupted their metabolism while they were warm-acclimated. Even minor thermal loading of the benthos would elevate metabolism adversely. (Jones-Wisconsin)
W71-05406

A TECHNICAL ASSESSMENT OF CURRENT WATER QUALITY CONDITIONS AND FACTORS AFFECTING WATER QUALITY IN THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05407

SANITARY BACTERIOLOGY OF THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, Md. Chesapeake Technical Support Lab.
Donald W. Lear, and Norbert A. Jaworski.
Bacteriological water quality status report for January to March 1967. CTSL Technical Report No 6, MAR, March 1969. 39 p, 7 fig, 13 tab, 6 ref.

Descriptors: *Bacteria, *Coliforms, *E. Coli, *Salmonella, Indicators, Estuaries, Water pollution effects, Water pollution sources, Water quality.
Identifiers: *Potomac River estuary, Coliform indicator relationships.

Data on the bacteriological water quality of the upper Potomac Estuary are presented. Coliforms and fecal coliforms are considered to be useful as indicators of bacterial pollution. Major sources of coliform organisms in the upper estuary are waste water discharges, storm and combined sewers a freshwater inflows. The contribution of colifo organisms from waste water effluents is found to hundredfold greater than from the freshwater flow from the upper basin. No estimate was ma of storm or combined sewer contributions. (Aal Chesapeake Technical Support Laboratory)
W71-05408

WATER QUALITY AND WASTE WATE LOADINGS UPPER POTOMAC ESTUARY DU ING 1969,
Environmental Protection Agency, Annapolis, M Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05409

POTOMAC-PISCATAWAY DYE RELEAS AND WASTE WATER ASSIMILATION ST DIES,
Environmental Protection Agency, Annapolis, M Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05410

UPPER POTOMAC RIVER BASIN WATE QUALITY ASSESSMENT,
Environmental Protection Agency, Annapolis, M Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W71-05411

SALMONELLOSIS IN CATTLE,
Ministry of Agriculture, Fisheries and Food, N wich (England). Veterinary Investigation Center
For primary bibliographic entry see Field 05F.
W71-05433

FISH STORY ANADROMOUS; I.E.,
Canadian International Paper Co., Montr (Quebec). Woodlands Research.
B. W. Flieger.
Science Affairs, Special Issue, Pesticides. . . there alternatives, Vol 4, No 3, September 1970 47-49.

Descriptors: *Water pollution effects, *Pesticid *DDT, *Salmon, *Spraying, Population.
Identifiers: Gaspe, Bay of Fundy (New Brunswic Canada.

Large scale aerial spraying with modest doses DDT insecticide over the budworm-infested fore of New Brunswick over a period of the past years is traced. The effects of the insecticide ha been successful for the trees, but in saving forests, the network of rivers leading to the Bay Fundy, the best remaining producers of the Atl tic Salmon, were infected by the insecticide. T effects the DDT has had on these salmon in all th various stages of several generations are outlin (Ensign-PAI)
W71-05499

PARAMETERS AFFECTING THE GROWTH ULVA LATISSIMA IN A POLLUTED ESTUAR
Northeastern Univ., Boston, Mass.
Thomas D. Waite, and Constantine Gregory.
North Eastern Regional Antipollution Conferen Annual, Proceedings, Kingston, Rhode Island, J 22-25, 1969, p 12-15.

Descriptors: *Estuaries, *Harbors, *Sewage, Wa pollution effects, *Algae.
Identifiers: *Ulva latissima, *Ammonia nitrogen.

Ulva latissima, a marine flora that has produc severe pollution problems due to its unrestrain growth in estuaries and harbors as a result domestic sewage fertilizing the marine enviro ment was studied. The correlation between a monia nitrogen concentration in seawater and r of growth of Ulva latissima was investigated. T

eatest growth rate is realized at 0.7 mg/l am-
onia nitrogen concentration. Reduction of am-
onia concentration to less than 0.5 mg/l is neces-
y to regulate excessive growth of Ulva latissima.
nsign-PAI)
71-05500

ARINE CHEMICAL POLLUTANTS
ETHODS OF STUDY AND RESULTS),
ntre d'Etudes et de recherches de Biologie et
Oceanographie Medicale, Nice (France).
r primary bibliographic entry see Field 05A.
71-05501

CROBIOLOGICAL DETERMINATION OF
ETHYL-MERCURY,
rhus Univ. (Denmark). Inst. of Hygiene.
r primary bibliographic entry see Field 05A.
71-05505

MPUTER SIMULATION OF PHYTOPLANK-
N GROWTH NEAR A MARINE SEWAGE
TFALL,
shington Univ., Seattle. Dept. of Oceanography.
C. Dugdale, and T. Whitledge.
vue Internationale D'Oceanographie Medicale,
l 17, p 201-210, 1970. 4 fig, 5 ref.

scriptors: Water pollution effects, *Sewage,
utlets, *Phytoplankton, Growth rates, *Simula-
n analysis, Eutrophication, Nutrients.
ntifiers: *Euphotic zone, Diffuser system.

sibility of a euphotic zone diffuser system by a
mputer simulation model is presented. Nutrient
itation principles and the available kinetic con-
nts for the uptake of ammonia and nitrate by
toplankton along with chemical analysis of ef-
ent composition are used. Maximum load per
t area of sea surface, current effects, incident
iation, effluent load and other variables can be
lied with the model. (Ensign-PAI)
1-05506

TENT EFFECTS OF INSECTICIDE INTOXI-
TION TO MARINE MOLLUSCS,
eau of Sport Fisheries and Wildlife, Highlands,
.
nald Eisler.
drobiologia, The Hague, The Netherlands, Vol
Issue 3-4, p 345-352, December 14, 1970. 3 tab,
ef.

criptors: *Mollusks, *Clams, *Gastropods, *In-
icides, *Fecundity, *Organophosphorus pesti-
es, DDT, Dieldrin, Endrin, Water pollution ef-
s, Pesticides, Lethal limit.
ntifiers: DDVP, Dioxathion, Methyl parathion.

rcenaria mercenaria and Nassa obsoleta were
jected to immersion in concentrations of 25
l of four organophosphorus insecticides or 10
l of four organochloride compounds at 24 parts
thousand, salinity and 20C. After 33 days it was
ed that there was a reduction in number of egg
es deposited by the gastropods immersed in
mparatively high concentrations of endrin, diel-
and lindane. Low concentrations of p,p'-DDT,
rin, dieldrin and lindane seemed to stimulate
ropod fecundity. DDVP and methyl parathion
igh concentrations decreased survival of both
ns and gastropods. (Ensign-PAI)
1-05508

ECTS OF MINERAL AND PETROLEUM
TRACTION ON LIVING RESOURCES OF
NTINENTAL SHELF WATERS,
shington Univ., Seattle.
es A. Crutchfield.
f and Caribbean Fisheries Institute. Annual Ses-
. Twenty First Proceeding, Miami, Florida,
ember 1968, University of Miami, Institute of
ine Sciences, Coral Gables, Florida, p 20-37,
9. 7 tab, 9 ref.

Descriptors: *Continental shelf, *Oil industry, *Mining, Water pollution effects, *Commercial fishing, Oil wastes, Aquatic environment.

Most of the fish caught in North American waters are taken from the continental shelf areas where interference or pollution from oil production and mining of minerals would significantly affect the American fishing industry. Current information on actual and potential production of fish and shellfish from the continental shelf of the United States is summarized. Conflicts which may arise between the mining industries and the fishing industries are discussed and qualitative evaluations of the indirect effects stemming from petroleum and mineral activity in offshore waters which might be of interest to seafood producers are mentioned. (Ensign-PAI)
W71-05510

ECOLOGICAL INVESTIGATIONS AROUND SOME THERMAL POWER STATIONS IN CALIFORNIA TIDAL WATERS,
Pacific Gas and Electric Co., Emeryville, Calif. Engineering Research Dept.
James R. Adams.
United States International Biological Program, Thermal Workshop, Second Proceedings, Solomons, Maryland, November 3-7, 1968, Chesapeake Science, Vol 10, No 3/4, p 145-154, September-December, 1969. 13 fig, 13 ref.

Descriptors: *Thermal pollution, *Nuclear powerplants, *Cooling, *California, *Coasts, Water pollution sources, Temperature, Ecology, *Tidal water.

Biological implications within known physical parameters at operation powerplants are discussed. A cooling water system for a steamplant is described, with possible variations of the design for intake and discharge. Review of some thermal studies at Pacific Gas and Electric Company powerplants in California are presented. Before a site is developed by P. G. and E., consultations and agreements with state resource agencies and conservation authorities are considered. Temperature predictions and ecological studies are done to predict effects of the plant on the ecosystem. (Ensign-PAI)
W71-05512

DISPOSAL, DISTRIBUTION AND EFFECTS OF ORGANIC AND INORGANIC CHEMICAL WASTE IN THE MARINE ENVIRONMENT,
Oslo Univ. (Norway). Inst. of Marine Biology.
Ernst Foyn.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 51-66, 1970. 2 tab, 3 fig, 3 ref.

Descriptors: *Chemical wastes, *Waste disposal, *Distribution patterns, Water pollution effects, Solubility.

Organic and inorganic waste disposal is an increasing problem all over the world. Concentration of the pollutant; physical, chemical and biological properties of the pollutant; solubility of the disposed material; and the ionic composition, strength, and pH of the recipient seawater are all factors to be considered in evaluating and predicting the effects of waste on the environment. Treating waste before disposal and chemical and biological methods for control after disposal are considered. (Ensign-PAI)
W71-05517

MANGANESE CONTENT AND THE OCCURRENCE OF FALLOUT 54MN IN SOME MARINE BENTHOS OF THE MEDITERRANEAN,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco); and Centre Scientifique de Monaco, Monte Carlo. Laboratoire de Radio-Activite Appliquee.
Walter Chipman, and Jean Thommeret.
Bulletin de l'Institut Oceanographique, Vol 69, No 1402, 1970. 15 p, 1 tab, 2 fig, 15 ref.

Descriptors: Water pollution effects, *Manganese, *Fallout, *Benthos, Radioactivity effects, Water pollution sources.
Identifiers: *Concentrations, *Occurrence, Distribution, Mediterranean Sea.

Marine benthos of the Mediterranean were investigated for accumulation of 54Mn. The manganese content of certain species of marine organisms and the distribution in the various organs and tissues were observed. The ascidian Halocynthia papillosa, the lamellibranch mollusc, Pinna nobilis, and the annelid worm, Hermione hystrix all showed high 54Mn content. Detectable amounts of 54Mn were found in the ash of the tube worm, Spirographis spallanzani. In Pinna the highest concentration of 54Mn was in the hepatopancreas. In polychaete worms concentrations were found in the external body structures. Although high radioactivity from fallout 54Mn was usually related to high manganese content in the organism, the specific activity of 54Mn varied. Among fallout radionuclides, 147 Pm seemed to be present in those organisms that concentrate 54Mn. (Ensign-PAI)
W71-05518

BACTERIOLOGICAL STUDIES IN THE BAY OF NAPLES,
Indiana Univ., Indianapolis. Dept. of Microbiology.
T. D. Brock.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 159-163, 1970. 1 tab, 3 ref.

Descriptors: Pollutants, *Bacteria, *Mollusks, *Marine plants, Ecology, Water pollution effects.
Identifiers: Epiphyte, Spirochete, *Bay of Naples.

The ecology of Leucothrix mucor and Cristispira were studies in the Bay of Naples. Leucothrix mucor is an epiphyte and is found throughout the Bay. Studies were conducted in relatively pollution-free Ischia and Sorrento and in the polluted waters at Naples between Santa Lucia and Mergellina. Cristispira is a spirochete living in some species of molluscs found in the Bay of Naples. The Bay, though very polluted, was found to still be suitable for the survival of clean water organisms such as Cristispira and Leucothrix. (Ensign-PAI)
W71-05520

THE INFLUENCE OF THE RIVER TYNE ON THE BACTERIOLOGICAL AND CHEMICAL QUALITY OF INSHORE WATERS OF THE NORTH EAST COAST OF ENGLAND,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
P. C. Head, and A. James.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 147-158, 1970. 3 tab, 13 ref.

Descriptors: *Water pollution effects, *Rivers, *Estuaries, *Chemical analysis, *Bacteria, Coliforms, Nutrients, Phytoplankton, Seasons.
Identifiers: Inshore waters, England (North East Coast), *River Tyne.

Chemical and bacteriological surveys have been conducted to determine the effect of domestic and industrial waste discharge on the waters near the mouth of the River Tyne in England. Coliform and Escherichia coli counts have shown that despite die-off and dilution surface layers contain significantly higher numbers of bacteria. The amount of nutrient elements discharged by the river per day is 1000 Kg of nitrogen and silicon, and 100 Kg of phosphorous. During the winter months there was an increase of these elements in the inshore waters. During spring and summer phytoplankton growth resulted in the removal of all the nutrients in the surface waters not directly influenced by the river discharge. In discharge areas higher levels of nutrients and higher standing crops of phytoplankton were found. (Ensign-PAI)
W71-05523

MICROORGANISMS GROWING IN OIL AND OIL PRODUCTS IN WESTERN AND CENTRAL REGIONS OF THE MEDITERRANEAN SEA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
O. G. Mironov.
Revue Internationale D'Oceanographie Medicale, Vol 17, p 79-85, 1970. 2 tab, 1 fig, 8 ref.

Descriptors: *Oil, *Microorganisms, *Bacteria, *Water pollution effects, Self-purification.
Identifiers: *Mediterranean Sea.

Composition and distribution of species of microorganisms growing in oil and oil products in the Mediterranean were studies. Bacterial growth was effected at 27 degrees C and was observed in 28 out of 54 seawater samples. Thirty nine cultures were separated belonging to the genera Pseudobacterium, Micrococcus, Pseudomonas, Bacterium, and Bacillus. Crude oil and diesel oil were used as the only source of carbon. Relationship was then noted between oil pollution of sea water and occurrence of microorganisms growing in oil and oil products. (Ensign-PAI)
W71-05524

SOME BIOGEOCHEMICAL CONSIDERATIONS ON THE RADIOACTIVE CONTAMINATION OF MARINE BIOTA AND ENVIRONMENTS,
International Laboratory of Marine Radioactivity, Monte Carlo (Monaco).
For primary bibliographic entry see Field 05A.
W71-05531

THE DIFFUSION OF BACTERIAL POLLUTION IN THE SEA,
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, P. Koch, and J. Garancher.
International Conference on Water Pollution Research, Fourth, Proceedings, Prague, Czechoslovakia, April 21-25, 1969, Pergamon Press, New York, p 793-809, 1969. 2 fig, 1 tab, 33 ref.

Descriptors: *Domestic wastes, *Bacteria, *Plankton, *Biomass, *Balance of nature, *Sewage, *Self-purification, Water pollution sources, Water pollution effects.

Investigations were made concerning the diffusion of bacterial pollution in the marine environment. It was deduced that the discharges of domestic waste water into a reconstituted marine environment affect the growth of the planktonic biomass favorably, even when the sewage rate is as high as 20%. At high concentrations these discharges slightly modify the ecological balance and tend to favor the efflorescence of protozoa. Antibiotic action caused by increased planktonic forms has proved to be greater than the bacterial growth enriched with sewage, and this eventually results in their total destruction. (Ensign-PAI)
W71-05547

THE BEHAVIOUR OF BACTERIA IN THE PRESENCE OF PRODUCTS RELEASED BY MARINE PHYTOPLANKTON,
Centre Hospitalo-Universitaire-Poitiers (France).
J. Brisou.
International Conference on Water Pollution Research, Fourth, Proceedings, Prague, Czechoslovakia, April 21-25, 1969, Pergamon Press, New York, p 783-791, 1969. 1 tab, 24 ref.

Descriptors: *Self-purification, *Phytoplankton, *Aerobic bacteria, *Anaerobic bacteria, *Marine plants, Water pollution effects, Metabolism.
Identifiers: Assimilation (Plants).

The possible relationships between phytoplankton and the aerobic and anaerobic microbial populations that exist in the marine environment are studied. This paper specificly discusses experiments relating to the part played by phytoplankton in the self purification of sea water. Marine plants assimilate and reject the products of metabolism, and contain rather characteristic substances. Those products that are apt to be released into the environment and those that are contained within the tissues and can only be released by physical disintegration or by lysis are considered separately. (Ensign-PAI)
W71-05549

NUTRIENT STUDIES IN HYPER-FERTILIZED ESTUARINE ECOSYSTEMS: I. PHOSPHORUS STUDIES,
Gulf Coast Research Lab., Ocean Springs, Miss.
Walter Abbott.
International Conference on Water Pollution Research, Fourth, Proceedings, Prague, Czechoslovakia, April 21-25, 1969, Pergamon Press, New York, p 729-746, 1969. 2 fig, 6 tab, 41 ref.

Descriptors: *Estuaries, *Pollutant identification, *Nutrients, *Ecosystems, *Model studies, Water pollution effects, Estuarine environment.

Metamorphic data, pond salinities, nutrient levels, P32 distribution and other data were tabulated from a model ecosystem. Eighteen experimental ponds were made by capturing a small bayou channel with cross-levees. This allowed an established estuarine bottom to form in the ponds. Pond volumes were determined by a dye-dilution technique using sodium fluorescein and a fluorimeter. Addition of nutrients, tracers, etc., were made from a skiff with an outboard motor which, when driven in a circular path in the center of the pond stirred the water without disrupting the sediments. (Ensign-PAI)
W71-05550

ESTIMATION OF THE MAXIMUM DOSE TO MAN FROM THE CONTAMINATION OF AN AQUATIC ECOSYSTEM WITH RADIONUCLIDES,
California Univ., Livermore. Lawrence Radiation Lab.
Arthur R. Tamplin.
Biological Implications of the Nuclear Age, Symposium. Proceedings, Livermore, California, March 5-7, 1969, AEC Lawrence Radiation Laboratory, Bio-Medical Division, Oak Ridge, Tenn, p 77-94, Dec 1969. 2 tab, 1 fig, 19 ref.

Descriptors: *Radioactivity effects, *Ecology, *Aquatic life, *Public health, Aquatic environment, Radioisotopes, Water pollution effects.
Identifiers: Maximum dose estimates.

A method for estimating the maximum internal dose to man, as a possible result of radionuclides released into an aquatic environment is discussed. With this method the nuclides that could contribute most to the internal dose, and determination of the contribution of each nuclide to the total dose, can be identified. The basic objectives of preshot radiation safety analysis and guidance for postshot documentation are accomplished by the results of this method. The analysis is useful as a guide for device design. (Ensign-PAI)
W71-05552

WATER RESOURCES POTENTIAL OF AN URBAN ESTUARY (SAUGUS RIVER, PINES RIVER AND LYNN HARBOR COMPLEX),
Northeastern Univ., Boston, Mass. Dept. of Civil Engineering; and Northeastern Univ., Boston, Mass. Dept. of Environmental Science.
John J. Cochrane, Constantine J. Gregory, and Gerald L. Aronson.
Available from NTIS as PB-197 991, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Water Resources Research Report, June 1970. 83 p, 29 fig, 7 tab, 44 ref. OWRR Project A-028-Mass (1).

Descriptors: *Estuaries, *Water pollution effect
*Water resources development, *Massachusett
*Eutrophication, Nutrients, Algae, Phosphate
Nitrates, Surveys, Pesticides, Waste disposal, Pa
of pollutants, Water quality.
Identifiers: *Boston (Mass), Lynn Harbor (Mass).

The water resources potential of the urba
estuarine complex comprised of the Saugus an
Pines Rivers and Lynn Harbor, Massachusetts, w
evaluated. Impairment of recreational usage
caused by eutrophication resulting from raw was
discharges and nutrient reserves in sediments.
laboratory study of the growth of marine alga
Ulva latissima, made in flowing sea water, indicat
an optimum growth at nitrogen-phosphorous rati
of between 40 and 60 to 1, at a phosphate conce
tration of 120 micrograms per liter. Average valu
for nutrients in eutrophic areas were 268 micr
grams/liter total orthophosphate and 0.513 mg
nitrates. Sediments from these areas average
5.98% volatile solids, 0.532 mg/l extracta
orthophosphates, and 2.177 mg/l total Kjelda
nitrogen. In contrast, oligotrophic areas, includi
parts of the Pines River, had averaged values of 1
micrograms/l total orthophosphate, 0.175 mg
nitrates, 0.79% volatile solids, 0.349 mg/l extracta
orthophosphates and 0.294 mg/l total Kjelda
nitrogen. (Knapp-USGS)
W71-05553

WATER QUALITY AND ITS EFFECT O WHITE FABRICS,
North Dakota State Univ., Fargo. Coll. of Hon
Economics.
Janice I. Buckner, and Coila M. Janecek.
Farm Research, Vol 28, No 1, p 18-21, Septembe
October 1970. 4 p, 2 fig. OWRR Project A-020-
DAK (2).

Descriptors: *Water pollution effects, *Cleanin
*Textiles, *Detergents, *Water quality, Colo
Soaps, Hardness (Water), Iron, Manganese, A
kalinity, Acidity, Testing, Test procedures, Evalu
tion.
Identifiers: *Laundering, *Water quality effec
*Fabric staining.

This study was designed to identify factors in wat
that cause discoloration of white fabrics and
determine if these factors have other damaging e
fects on the fabrics such as loss of strength. T
Kindred area of Cass County, North Dakota, w
selected for the study. Water in this area is ha
and contains iron and manganese in sufficie
quantity to cause staining of white fabrics. All co
and hot water supplies were found to have p
values between 7.0 and 8.8. A Photovolt reflecti
meter was used to determine the whiteness of t
unlaundered swatches and to measure the amou
of discoloration of the laundered swatches. T
swatches showing the greatest increase in perce
of yellowness were laundered in moderately to ve
hard water. In order to determine if the minerals
solution had been detrimental to the fabric, te
were made for breaking strength. After 20 lau
derings, all but two swatches showed a decrease
fabric strength in the length-wise (warp) directio
The swatches having the greatest decrease in fab
strength had been laundered in hot water classifi
as very hard or over 10.5 grains per gallon of har
ness. There was no significant difference betwe
waters samples in the fall, winter and sprin
(Woodard-USGS)
W71-05617

SEDIMENT-WATER NUTRIENT RELATIO SHIPS - PARTS 1 AND 2,
Federal Water Quality Administration, Cincinna
Field Investigations Branch.
For primary bibliographic entry see Field 05B.
W71-05626

SOME ALGAE OF THE UPPER CUYAHOG RIVER SYSTEM IN OHIO,
Kent State Univ., Ohio. Dept. of Biologic Sciences.

r primary bibliographic entry see Field 05A.
71-05629

NGIA ATROPURPUREA (ROTH) A. IN ESTERN LAKE ERIE,
io State Univ., Columbus. Dept. of Botany.
r primary bibliographic entry see Field 05A.
71-05630

OASSAY PROCEDURES FOR OIL AND OIL SPERSANT TOXICITY EVALUATION,
tional Marine Water Quality Lab., Kingston, R.I.
les LaRoche, Ronald Eisler, and Clarence M.
rzwell.
rnal Water Pollution Control Federation, Vol No 11, p 1982-1989, November 1970. 1 fig, 5 , 9 ref.

scriptors: *Bioassay, *Toxicity, *Oil drilling, nelids, Crustaceans, Seawater, Hydrogen-ion ncentration, Salinity, Dissolved oxygen, Oil stes.
ntifiers: Cyprinodontiform teleosts, Crude oil.

boratory procedures are listed for the deter- nation of relative 96-hr toxicities of crude oils, spill removers, and oil-dispersant mixtures to resentative cyprinodontiform teleosts, ychaete annelids, and decapod crustaceans. ttle-Battelle)
71-05632

A,
ildren's Cancer Research Foundation, Inc., ston. Lab. of Environmental Toxicology; and ildren's Cancer Research Foundation, Inc., ston. Lab. of Carcinogensis.
nuel S. Epstein.
vironment, Vol 12, No 7, p 2-11, September 70.

scriptors: *Detergents, *Phosphates, *Water lution treatment, *Toxicity, Acids, Eutrophica- n, Chelation, Water pollution effects, Sewage, duction (Chemical), Nutrients.
ntifiers: Nitrilotriacetic acid, Carcinogens, A.

e substitution of NTA for phosphates in deter- nts may pose problems greater than the eutrophi- ion associated with the use of phosphates. NTA entially may cause kidney damage, may chelate tal ions and thereby damage many types of uipment, or may degrade into secondary amines l become carcinogenic. (Little-Battelle)
71-05639

SIDUES IN FISH, WILDLIFE AND ESTUA- ES,
reau of Commercial Fisheries, Gulf Breeze, Fla.
nter for Estuarine and Menhaden Research.
r primary bibliographic entry see Field 05B.
71-05643

ILIZATION OF ALKOXYSILANES FOR DUCTION OF THE ABUNDANCE OF YTOPLANKTON DURING 'BLOOMS' OF ATER BASINS (IN RUSSIAN),
scow State Univ. (USSR).
r primary bibliographic entry see Field 05F.
71-05719

E PROBLEM ON THE FARM: ANIMAL ALTH,
nistry of Agriculture, Fisheries and Food, Nor- h (England). Veterinary Investigation Service.
. J. Venn.
ceedings of Symposium: Farm Wastes: The In- ute of Water Pollution Control and The Univer- of Newcastle upon Tyne, Paper No 4, p 24-29, 70. 41 ref.

scriptors: *Toxicity, *Hazards, *Diseases, Farm stes, Copper, Nitrogen, Potash, Lagoons, Slur- ries, Animal diseases, Bacteria, Viruses, Pathogenic bacteria.
Identifiers: United Kingdom, Toxic gases, Toxic chemicals, Parasites, Contamination, Health.

Health hazards associated with farm wastes have attained prominence with the development of intensive systems of husbandry. Whilst certain of the problems are unique to intensive systems, most of them are not new. This paper is an attempt to indicate some of them. An account is given of certain hazards to animal health arising from farm wastes, notably slurry and toxic chemicals. Possible ways of limiting these hazards are suggested. A discussion of the paper follows. (See also W71-05747). (Christenbury-Iowa State)
W71-05751

FARM WASTES: PUBLIC HEALTH AND NUISANCE PROBLEMS OFF THE FARM,
Chelmsford Rural District (Essex). Chief Health Inspector.
For primary bibliographic entry see Field 05F.
W71-05752

MONITORING OF THE MARINE ENVIRONMENT FOR WASTE COMPONENTS AND FOR EFFECTS OF THE INTRODUCED WASTES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05A.
W71-05789

PHYSICAL EFFECTS ON RECEIVING WATERS,
California Univ., Berkeley. Dept. of Civil Engineering.
Robert E. Selleck.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy on Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p VIII 1-VIII 6.

Descriptors: *Wastes, *Waste water, *Environment, *Oil wastes, Water pollution sources, Water pollution effects.
Identifiers: *Receiving waters, *Surface materials, Surface phenomena, Interfacial phenomena.

The surface or interfacial problems due to foreign matter discharged into the marine and estuarine environment are explained. Films, lenses, scum, foam, and detritus are some of the forms of this surface material. These materials are classed as monolayers and duplex films and the actions, formation, physical effects and approximate relationships of these films are discussed. Natural sea slicks, surface materials of waste water origin and interfacial phenomena are mentioned with suggestions for future investigations on the physical effects of foreign substances on receiving waters. (See also W71-05787) (Ensign-PAI)
W71-05795

CHEMICAL AND GEOCHEMICAL EFFECTS ON RECEIVING WATER,
Alaska Univ., College. Inst. of Marine Sciences.
Donald W. Hood.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p IX 1-IX 45. 4 tab, 41 ref.

Descriptors: *Chemical properties, *Geochemistry, *Wastes, *Sediments, Pesticides, Absorption, River flow, Mining, Oil, Nutrient requirements.
Identifiers: *Receiving waters, *Waste effects.

Man's capacity to destroy the 'inexhaustable' oceans is at last being realized. The cycles in the oceans are very slow. What was predicted as safe a few years ago is no longer proving valid. With this in mind the author discusses some chemical and geochemical effects on receiving water. Chemical properties of waste components affecting their absorption on organic and inorganic particulates and sediments, pesticide uptake by suspended inorganic materials and organic particulate and the exchange coefficients for the sediment - water interface affecting cycling of waste components are included. He also discusses the role of river inflow and chemical scavengers of waste components in the sea, mineral harvesting on chemical character of continental shelf waters and sediments, and the nutrient budget of oceans and estuaries. (See also W71-05787) (Ensign-PAI)
W71-05796

CHEMICAL AND GEOCHEMICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT, AND CHEMICAL AND GEOCHEMICAL EFFECTS ON THE RECEIVING WATERS,
California Inst. of Tech., Pasadena; and Pomeroy, Johnston, and Bailey, Pasadena, Calif.
For primary bibliographic entry see Field 05B.
W71-05797

BIOLOGICAL EFFECTS OF WASTE DISCHARGES ON COASTAL RECEIVING WATERS,
Engineering-Science, Inc, Forest Hills, N.Y.; and Engineering-Science, Inc., Arcadia, Calif.
Neal E. Armstrong, and Philip N. Storrs.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p XII 1-XII 40. 2 tab, 49 ref.

Descriptors: *Wastes, *Aquatic life, *Standing crop, *Productivity, *Bioindicators, *Pesticides, *Toxicity, Analytical techniques, Data processing, Application methods.
Identifiers: Microplankton, Zooplankton, Benthic animals, Large invertebrates, Fish, Diversity indices, Biostimulation, Receiving waters.

Background for discussion of the biological effects of waste materials on receiving waters is presented. Quantitative as well as qualitative data is needed in sampling methods. Identification of biological components and determination of numbers per unit area and/or per unit volume of water are of concern. Microplankton, zooplankton, benthos, large invertebrates, fish and microbes are catagorized in this way. Parameters for biological community structure and response are described by standing crop, productivity, diversity indices and indicator organisms. Analytical methods, data processing and application for biota quantification and community structure parameters are described. Assessment and allowable concentrations for toxicity; model prototype simulation, theory and rationale, and kinetics of biostimulation; and definition, problems, exposure, analytical methods, sources, transport, decay and treatment of pesticides are outlined. Existing knowledge is assessed and objectives for further investigations proposed. (See also W71-05787) (Ensign-PAI)
W71-05799

BIOLOGICAL EFFECTS ON RECEIVING WATERS,
Maryland Univ., Solomons. Natural Resources Inst.
Eugene L. Cronin.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p XIII 1-XIII 25. 37 ref.

Descriptors: *Wastes, *Toxicity, *Biology, *Monitoring, *Organic compounds, *Inorganic compounds, Pathogenic bacteria, Public health.
Identifiers: *Field tests, Laboratory tests.

The partial assessment of toxicity and estimation of allowable concentrations in receiving waters are discussed with emphasis on the magnitude and gravity of our limitations. Before and after surveys, disposal site and control site comparisons, pre-planned site-and-'control' comparisons and wide scale biological monitoring along with laboratory studies were conducted. The possibilities and difficulties involved in biostimulation by inorganic and inorganic wastes and assay of biostimulatory effects are considered. Health risks from pathogens and quantitative measures of community health are mentioned. (See also W71-057877) (Ensign-PAI)
W71-05800

BIOLOGICAL PROCESSES WHICH INTERACT WITH AND INFLUENCE THE DISTRIBUTION OF WASTES INTRODUCED INTO THE MARINE ENVIRONMENT,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 05B.
W71-05801

BIOLOGICAL EFFECTS ON RECEIVING WATERS: THE PLANKTON,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
J. D. H. Strickland.
Background Papers on Coastal Wastes Management, prepared for National Academy of Sciences Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering, Wash, DC, Vol 1, 1969, p XVII 1-XVI 23. 39 ref.

Descriptors: *Wastes, *Waste water disposal, *Environmental effects, Biology, Ecology, Toxicity, Plankton, Eutrophication.

The reactions of plants and animals to changes in the environment caused by man's activities are considered. A decision as to what is beneficial use of our coastal waters must be made in order to know to what extent their use is being jeopardized. Measuring the biota and its environment in time and space to establish a norm is essential in proving pollution. Twelve months of monitoring of the environment before introducing the foreign matter is necessary. Methods for measuring the biota and the environment, waste water disposal and toxicity assessment are presented. The biology which underlines the phenomena of eutrophication in the sea and effects on the plankton are discussed. (See also W71-05787) (Ensign-PAI)
W71-05803

STUDY OF AN ECOSYSTEM IN THE COASTAL WATERS OF THE LIGURIAN SEA, III. MACROBENTHIC COMMUNITIES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco).
Gilat Eliezer.
IAEA Radioactivity In The Sea, Publication No 27, 1969. 76 p, 7 fig, 6 tab, 64 ref.

Descriptors: *Ecosystems, *Benthos, *Biomass, *Radioactivity effects, Radionuclides, Food chains, Absorption, Water pollution effects.
Identifiers: *Biocenosis, *Ligurian Sea, Bay of Lion, Adriatic Sea, Mediterranean Sea, North East Atlantic.

Benthic communities on the continental shelf off Monaco were studied. The area and methods of sample collection are described. Biocenosis of the infralittoral and circalittoral shelves in the Bay of Roquebrune and adjacent areas are studied. Discussion of the biomass and benthic communities of the Mediterranean Sea, Adriatic Sea and the North East Atlantic are discussed and compared with those of the Bay of Roquebrune. (Ensign-PAI)
W71-05809

THE EFFECTS OF THERMAL EFFLUENT ON SOME OF THE MACROFAUNA OF A SUB-TROPICAL ESTUARY,
Florida Power and Light Co.
Richard S. Nugent, Jr.
University of Miami, Sea Grant Program, (Estuarine and Coastal Studies), Sea Grant Technical Bulletin, Number 1, August 1970. 198 p, 29 fig, 19 tab, 145 ref. Sea Grant Technical Bulletin Number 1.

Descriptors: *Estuaries, *Thermal pollution, *Ecology, *Marine animals, Water pollution effects, Florida, Environmental effects.
Identifiers: Turkey Point, *Biscayne Bay.

The effects of heated discharge water from an electric generating facility on the populations of some macrofauna in the waterways of the mangrove region of Biscayne Bay were studied. Qualitative and quantitative investigations were conducted on the kinds, distribution, and abundance of several species of fishes and invertebrates. Hydrological parameters were monitored routinely throughout the study area. Decreased abundance of many species along with other factors indicated that the thermal effluents were detrimental to the animal populations of the area. (Ensign-PAI)
W71-05811

5D. Waste Treatment Processes

STATE OF THE ART REVIEW ON SLUDGE INCINERATION PRACTICE,
Resource Engineering Associates, Wilton, Conn.
S. Balakrishnan, D. E. Williamson, and R. W. Okey.
Copy available from GPO Sup Doc as I67.13/4:17070 DIV 04/70, $1.25; microfiche from NTIS as PB-197 888, $0.95. Water Pollution Control Research Series, 17070, DIV/04/70, April 1970. 135 p, 20 tab, 40 fig, 61 ref. FWQA, Program 17070 DIV, 04-70.

Descriptors: *Incineration, *Sludge disposal, *Domestic wastes, Solid wastes, Dewatering, *Incineration, *Sludge disposal, *Domestic wastes, Solid wastes, Dewatering, Hydration, Colloids, Centrifugation, Sedimentation, Flotation, Detergents, Biochemical Oxygen Demand, Air Pollution, Waste disposal, Waste water treatment, *Sludge treatment, Reviews.
Identifiers: *Pretreatment, Thickening.

The current status of the incineration art and the associated costs are presented. Principal emphasis is placed upon sludge thickening, sludge conditioning, sludge dewatering, sludge incineration systems, and the design and operation of incinerators. The attitudes of state agencies and consulting engineering firms towards the design and operation of incinerators is included. Conclusions reached are: (1) on-site disposal in limited space requires developments far more efficient in disposing of solids; (2) much improvements in pretreatment steps is essential; (3) addition of other combustible materials may enhance the efficiency of combustion of sludge; and (4) although several systems are currently available there is great need for investigation and updating of the process methods. (Lowry-Texas)
W71-05384

ELECTROOSMOTIC PUMPING FOR DEWATERING SEWAGE SLUDGE,
North American Rockwell Corp., Canoga Park, Calif. Rocketdyne Div.
Jerome Greyson.
Copy available from GPO, Sup Doc as I67.13/4:ORD-17070 EHE 07/70, $0.65; microfiche from NTIS as PB-197 889, $0.95. Water Pollution Control Research Series, ORD 17070 EHE 07/70, July 1970. 59 p, 17 tab, 17 fig, 9 ref, 2 append. FWQA Program 17070EHE.

Descriptors: *Electroosmosis, *Dewaterin *Sewage sludge, Incineration, Membrar processes, Osmosis, Separation techniques, *Was water treatment.
Identifiers: *Electroosmotic pumping.

An experimental program was conducted to dete mine equipment configurations for efficient soli removal, identification of critical parameters i volved in the efficiency of electroosmotic pumpin and the design and testing of two prototype ele troosmotic pumps. It was determined that ele troosmosis can be applied to dewatering was sludges of various types. For efficient dewateri from very wet sludge (2%) to burnable solids, it necessary to orient the pumping apparatus with cathode screen beneath the anode so that an initi sludge film can be formed by gravity settling at t cathode surface. Sludge cannot be thickened to solids level exceeding 20% if the cake is benea the liquid level of the sludge suspension and f drying beyond the 20% value, the cake must brought out of the liquid. (Ellis-Texas)
W71-05385

ADVANCED WASTE WATER TREATMEN USING POWDERED ACTIVATED CARBON RECIRCULATING SLURRY CONTRACTO CLARIFIERS,
Infilco, Tucson, Ariz.
C. F. Garland, and R. L. Beebe.
Copy available from GPO Sup Doc I67.13/4:ORD-17020EKB07/70, $0.75; microfich from NTIS as PB-197 890, $0.95. Water Pollutio Control Research Series ORD-17020 FK 07/7 July 1970. 81 p, 10 tab, 31 fig, 10 ref, appen FWQA Program 17020 FKB.

Descriptors: *Activated carbon, *Solids conta process, *Slurries, Pilot plant, Adsorption, Flocc lation, Organic loading, Biochemical oxygen d mand, Chemical Oxygen demand, *Tertiary trea ment, *Waste water treatment, Sludge treatmer Activated sludge.
Identifiers: *Activated sludge plant effluer *Polyelectrolytes, *Clarifier, Regeneration, Reci culation, Counter-current flow, Hydraulic loading

Pilot-scale studies dealing with the use of recirc lating-slurry solids-contact clarifiers in treating a tivated sludge plant effluent were studied. Evalu tion of all available materials led to selection Darco S-51 activated powdered carbon and P rifloc C-32 polyelectrolyte flocculating agent, wi 6 to 7 mg/l of polyelectrolyte required at a carb feed rate of up to 140 mg/l. 30% greater carbon e ficiency, as opposed to a single stage convention unit, was achieved with a single slurry unit, wh results for two series clarifiers were comparable that of two conventional counter-current adsor tion systems requiring multiple agitated tank clarifiers, and filters. Hydraulic loading rat ranged from 0.4 to 1.6gpm/ft sq and influent BO ranged from 23 to 34 mg/l. Dual stage counter-cu rent contactors with 67, 146, and 266 mg/l of ca bon achieved 60, 72' and 84 per cent COD redu tion with residuals of 10.3, 7.4 and 4.4 mg/l respe tively. Estimated costs for a 10 mgd plant with 2 mg/l and 8 mg/l dosages of carbon and polyele trolytes respectively are 15 cents/1000 gal for a mgd plant, and 12.7 cents/1000 gal for a 100 mg plant. Further cost reductions could be possible the event that effluent quality restrictions wou allow a decrease in the carbon dosates. (Lowr Texas)
W71-05386

MATHEMATICAL MODEL OF RECALCINA TION OF LIME SLUDGE WITH FLUIDIZE BED REACTORS,
General American Transportation Corp., Niles, Ill
G. J. Ducar, and P. Levin.
Copy available from GPO, Sup Doc I67.13/4:ORD17090 EHQ 09/70, $0.5 microfiche from NTIS as PB-197 891, $0.9 Water Pollution Control Research Serie ORD17090 EHQ 09/70, Sept 1970. 49 p, 1 tab,

, 36 ref. I67.13/4:ORD 17090EHQ0970. FWQA ogram 17090 EHQ.

escriptors: *Computer programs, *Computer odels, *Lime, Mathematical models, Hydration, lcium Carbonate, Water softening, *Pulp stes, *Tertiary treatment, Sludge treatment, Vaste water treatment.
entifiers: *Recalcination, Fluidized bed, clone, Calcium oxide.

computer program, based on data collected from iterature review and from actual plant operation pulp mills and a water softening plant, has been veloped to evaluate lime sludge recalcination erations. Since fluidized bed reactor have not yet en installed commercially, no data was available. e models developed represent the recalcination ocess as applied to tertiary treatment plants. This ogram was designed for use as a subroutine in the ecutive program, 'Preliminary Design of Waste ter Treatment Systems,' which is used to optnize and evaluate new waste water treatment tems to be funded by the FWQA. (Lowry-Tex-

71-05387

IE DEVELOPMENT OF A FLUIDIZED-BED CHNIQUE FOR REGENERATION OF POW-RED ACTIVATED CARBON,
ttelle Memorial Institute, Columbus, Ohio. lumbus Labs.
K. Reed, T. L. Tewksbury, E. A. Wasto, J. G. ce, and G. R. Smithson, Jr.
py available from GPO Sup Doc as .13/4:ORD-17020FBD 03/70, $0.55; crofiche from NTIS as PB-197 892, $0.95. ater Pollution Control Research Series, ORD-020 FBD 03-70, March 1970. 43p, 15 tabs, 17 FWQA Program 17020 FBD.

scriptors: *Activated carbon, *Adsorption, wage treatment, Tertiary treatment, Solids con- t process, *Waste water treatment.
ntifiers: *Fluidized-bed, *Regeneration.

sults of research conducted as the Columbus boratories of Battelle Memorial Institute on the generation of spent powdered carbon is scribed. The study was directed toward the velopment of a fluidized-bed regeneration hnique in which two systems were investigated. e was a system in which the dried spent carbon s regenerated during its passage through a idized-bed of inert material while the other tem consisted of a pulsating fluidized-bed tem in which the finely divided regenerated car- n served as the bed material. Although both tems restored the spent powdered carbon to % of its original adsorptive capacity and overed 80% by weight, the fluidized inert bed s chosen for larger scale development because of higher unit capacity. A pilot-scale unit was signed and constructed to process 30 pounds of nt carbon in an 8 hour period. This unit was inrated in a powdered carbon adsorption process l tested for 23 days. The results indicated that enerated carbon was as effective as virgin car- n for organic removal for at least 3.6 cycles ough the system. An economic analysis inated that operating costs would be about 1 cent pound for a commercial plant producing 000 pounds of regenerated carbon per day. (El-Texas)
71-05388

TIMIZING LIPID BIOSTABILIZATION,
dwest Research Inst., Kansas City, Mo.
Garner.
py available from GPO Sup Doc as .13/4:ORD-17050FIMDS170, $0.60; crofiche from NTIS as PB-197 893, $0.95. deral Water Quality Administration, Water Pol- on Control Series, ORD-17050 FIM 05/70, May 70. 57 p, 14 tab, 11 fig, 23 fig, 2 append. FWQA ogram 17050 FIM.

Descriptors: *Optimization, *Lipids, *Anaerobic conditions, Digestion, Anaerobic digestion, Degradation, Lime, Chemical oxygen demand, *Waste water treatment.
Identifiers: *Biostabilization, Homogenization, Buffers.

Laboratory scale anaerobic digestion studies were carried out to determine the effect of high-shear mixing on the degradation of lipids. The studies showed that the intensity of mixing must be carefully tailored to the rate and type of feed if benefits are to be realized. Dog food, cottonseed oil, and motor oil were fed to the digesters daily as slug loads. When properly operated, the 15 replicate digesters gave reproducible results with good precision. High-shear mixing has little effect on degradation of dog food and was deleterious to lime-buffered solutions heavily loaded with cotton seed oil. When soda ash was used as a buffering agent, heavy loads of oil caused the digester to 'go sour' regardless of the mixing system. Under some conditions homogenization led to serious foaming in the digestors. Kinetic data and chemical analysis of drawdown samples confirmed the hypothesis that homogenization or soda ash buffering can accelerate the hydrolysis of a heavy load offat to a point where the saponification products over load the methane fermentation. Motor oil was not readily digested but did not appear to influence the digestion of cottonseed oil or dog food. Other observations were: (1) more rapid gasification occurs as the feed rate increases; (2) lime and soda ash cannot be used interchangeably as buffers; and (3) feed COD cannot be used to predict methane yield. (Ellis-Texas)
W71-05389

FAULKS V BOROUGH OF ALLENHURST (INSTALLATION OF SEWAGE TREATMENT PLANT ON PUBLIC ROAD EASEMENT).
For primary bibliographic entry see Field 06E.
W71-05403

CONTROL OF WATER POLLUTION FROM SOUTHWESTERN CATTLE FEEDLOTS,
Texas Tech Univ., Lubbock. Water Resources Research Center.
D. M. Wells, W. Grub, R. C. Algin, G. F. Meenaghan, and E. Coleman.
Proceedings, 5th International Water Pollution Research Conference, July-August 1970, Paper II-38. 19 p, 20 tab. FWPCA Demr. Grant 13040, Texas Water Quality Board Contr. IAC (68-69).

Descriptors: *Farm wastes, *Cattle, *Manure, *Runoff, Biochemical oxygen demand, Nutrients, *Aerobic treatment, Anaerobic digestion, Irrigation, Waste water treatment.
Identifiers: *Feedlot runoff, Plant toxicity.

The objectives were to determine the characteristics of solid and liquid wastes resulting from cattle feedlot operations in the southwest U.S., to determine the treatability of these wastes by aerobic and anaerobic treatment systems and to determine whether or not the wastes produced could be used in a beneficial manner for the growing of cash crops. The feedlots studied included concrete-surfaced lots, dirt-surfaced lots, and controlled environmental chambers located on the Texas Tech University campus. Among their conclusions were that within reasonable limits, quality of runoff was not materially affected by type of ration fed or quantity of precipitation. Treatment of runoff resulting from precipitation on beef cattle feedlots is not feasible by conventional treatment systems. Direct application of runoff from concrete-surfaced lots was highly detrimental to the crops they tested. Direct application of runoff from dirt lots had an inhibitory effect on most crops tested except Midland Bermuda grass. Storage of runoff in unlined ponds may result in substantial pollution of the groundwater in the vicinity. They concluded that liquid systems for handling cattle feedlot wastes were not feasible. (Miner-Iowa State)
W71-05412

EQUIPMENT FOR DISPOSAL OF AGRICULTURAL EFFLUENTS,
National Agricultural Advisory Service, London (England).
C. Culpin.
Chemistry and Industry, p 350-353, February 29, 1964. 3 ref.

Descriptors: *Farm wastes, *Disposal, Effluents, Slurries, Storage tanks, Silage, Distribution, Methane, Mixing, Distribution systems, Sprinkler irrigation, Pumps, Labor, Odor, Waste disposal, Waste water treatment.
Identifiers: Agitation, Vacuum pumping, Tanker.

Types and quantities of manure and other effluents are described, as well as systems and equipment for their disposal in Britain. Different storage methods and means of agitation or mixing are described. Four distribution systems are discussed. These include either some type of sprinkler irrigation or a tank wagon method. Labor requirements for both distribution methods, as well as future prospects are given. (White-Iowa State)
W71-05413

DISPOSAL OF FARM EFFLUENT,
Ministry of Agriculture, Fisheries and Food, Norwich (England). Veterinary Investigation Center.
E. A. Gibson.
Agriculture, Vol 74, 1967, p 183-188.

Descriptors: *Slurries, *Farm wastes, *Salmonella, Cattle, Hogs, Infection, Incubation, Diseases, Gases, Hydrogen sulfide, Ammonia, Carriers, Waste water treatment, Waste disposal.
Identifiers: *Disease hazard, Anthrax, England, Johnes disease, Avian tuberculosis, Salmonella dublin, Salmonella typhimurium.

The possibility of spreading infection by the use of slurry manure disposal techniques is discussed. It is well known that many infections of farm live-stock are spread in their excreta. Little is known about the effects of such spread as slurry on the land, but under certain circumstances, the use of these systems could increase the disease hazard. Salmonella infection and Johnes disease are discussed in this respect, and anthrax and avian tuberculosis are mentioned more briefly. It is suggested that effluents thought to contain salmonella should not be put on the pasture or fodder crops that will be used for cattle or sheep within six months. The same precaution applies to Johnes disease, except that for cattle up to six months old, the period should be extended to twelve months. These figures may need to be revised as further knowledge and experience is gained. The non-infectious hazards to animal health include the liberation of toxic gases when slurry is agitated or emptied. (White-Iowa State)
W71-05414

DIGESTION TESTS OF LIVESTOCK WASTES,
California Univ., Davis. Dept. of Agricultural Engineering.
Samuel A. Hart.
Journal of the Water Pollution Control Federation, Vol 35, No 6, June 1963, p 748-757. 7 fig, 2 tab, 11 ref.

Descriptors: *Farm wastes, *Poultry, *Cattle, *Sludge digestion, Stabilization, Hydrogen ion concentration, Alalinity, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Carbon, Organic matter, Sewage, Odor, Gases, Waste water treatment.
Identifiers: *Dairy cattle, Volatile acids, Digesters, Gas production.

A laboratory test on the digestion of chicken and dairy manures indicates the following: (1) Both chicken and dairy manure would be stabilized satisfactorily in high-rate digesters equipped with adequate sludge-mixing equipment. (2) Dairy manure, because of its high lignin content, will effect organic matter destruction of only 10-15 percent. (3) The destruction of volatile matter expected from digesting chicken manure closely ap-

proximates that of municipal sludge digestion. (4) Operational parameters of pH, alkalinity, volatile acids, and the effect of temperature follow those expected for municipal sludge digestion. (5)Although nitrogen levels of chicken manure are high, digestion does not cause loss of nitrogen, but rather, through destruction of organic matter, it is concentrated to 8 or 9 per cent in the digested sludge. (6) BOD and COD are best expressed in terms of O2/mg VS for the high solids content of manures and manure sludges. (7) COD on a mg O2/mg VS basis increases upon digestion since digestion is a reducing reaction. (8) In total, digestion appears to have merit for stabilizing chicken manure. Consideration would still have to be given to final disposition since digestion does not destroy the waste. (White-Iowa State)
W71-05416

FLUSHING AWAY MANURE PROBLEMS,
Hog Farm Management, Minneapolis, Minn.
Cliff Johnson.
Hog Farm Management, Vol 8, No 1, p 23-25 and 68, January 1971. 7 fig.

Descriptors: *Recirculated water, *Disposal, Farm wastes, Reclaimed water, Lagoons, Hogs, Odor, Labor, Waste water treatment.
Identifiers: *Flushing gutters, Oxidation ditches, Siphon mechanism, Swine, Collection, Automatic dosing siphon.

The flushing gutter system being experimented with at Iowa State University is described. Two variations of the flushing technique, one utilizing a solenoid flushing mechanism and the other a siphon mechanism, have been studied. In the first case, water fills an overhead tank which trips the solenoid causing a plug to lift and thus discharging the tank's contents. For the siphon system, a tank is fitted with 2 1/2 in. N-shaped trap pipe underneath. As the tank fills with water, enough water pressure is built up to force the tank's contents down the pipe into the gutter. The water is discharged rapidly (150 gal. in 62 sec.) through the 2 1/2 in. pipe. Because of the water's force as it is flushed, no dung is left in the gutter after flushing. The gutter is flushed three times per day. Advantages of the system include (1) reduced ventilation requirements, (2) less odor, (3) better feed efficiency, (4) no gas problem, and (5) no labor involved in manure removal. (Christenbury-Iowa State)
W71-05417

FERTILIZATION OF ANNUAL RANGELAND WITH CHICKEN MANURE,
California Univ., Riverside. Dept. of Agronomy.
Cyrus M. McKell, Victor W. Brown, Robert H. Adolph, and Cameron Duncan.
Journal of Range Management, Vol 23, p 336-340, 1970. 2 fig, 6 tab, 4 ref.

Descriptors: *Poultry, *Grasslands, *Farm wastes, Fertilizers, Costs, Range management, Cost-benefit analysis, Crop response, Phosphorus, California, Proteins, Waste water treatment.
Identifiers: *Chicken manure, Palatability, Rangeland fertilizer.

Where annual rangelands are close to the source of supply, fertilization with chicken manure appears to hold considerable promise in improving the production of forage for grazing. Fertilized polts were ready to be used earlier in forage of a higher quality and palatability. Protein and phosphorus were significantly higher in forage from fertilized plots. Fertilizer value of chicken manure is equal to equivalent rates of commercial fertilizer. There appears to be a slower release of fertilizer elements from chicken manure than from inorganic fertilizer. Annual forage legumes do not appear to benefit initially from the application of chicken manure. In subsequent years following fertilization, the legumes appear to thrive on the increased level of available phosphorus. It was profitable for rangeland operators to fertilize with poultry manure provided they could get it for $3 10 to $4.35 per ton applied. An average of 1,600 pounds of extra feed was obtained for each ton of manure. (Christenbury-Iowa State)
W71-05419

ANIMAL WASTES - A NATIONAL PROBLEM,
Cornell Univ., Ithaca. Dept. of Agriculture; and Cornell Univ., Ithaca. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-05420

AGRICULTURE AND THE PREVENTION OF RIVER POLLUTION, AS EXPERIENCED IN THE WEST OF SCOTLAND,
Clyde River Purification Board (Scotland).
For primary bibliographic entry see Field 05B.
W71-05421

WHIPPING THE MANURE PROBLEM,
Alan Linn.
Farm Quarterly, Winter 1966-1967, p 56-59, 115-116. 4 fig, 2 tab.

Descriptors: *Farm wastes, *Hogs, *Oxidation, *Aerobic bacteria, Labor, Odor, Fertilizer, Value, Organic matter, Carbon dioxide, Water, Nitrogen, Ammonia, Nitrites, Nitrates, Phosphorus, Potassium, Hydrogen sulfide, Methane, Anaerobic bacteria, Aeration, Design standards, Volume, depth, Foaming, Dispersion, Costs, Submergence, Biochemical oxygen demand, Oxygen, Temperature, Waste water treatment.
Identifiers: *Oxidation ditch, *Paddle wheels, Agitation, Circulation, Batch system, Continuous system, Paddle wheel diameter, Slatted floors.

The oxidation ditch is described as an important new breakthrough in manure handling. Advantages of the oxidation ditch include savings in labor, handling manure as a liquid, elemination of almost all odor, and the preservation and concentration of fertilizer nutrients. Basic design standards are given for the ditch and paddle wheel. If the ditch is managed on a continuous basis, 1 1/2 percent of the ditch volume can be added as manure daily. General management requirements and costs are included. The paddle wheel with a 1 1/2 to 3-hp motor costs about $600. The ditch walls can be incorporated into the building's foundation. Estimated power costs are about $1.00 per hog and $8.20 per 1000 pound dairy cow per year. Many changes in confined livestock production through use of the oxidation ditch are contemplated. (White-Iowa State)
W71-05422

EFFLUENT QUALITY FROM ANAEROBIC LAGOONS TREATING FEEDLOT WASTES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Raymond C. Loehr.
Journal Water Pollution Control Federation, Vol 39, No 3, March 1967, p 384-391. 6 tab, 12 ref.

Descriptors: *Farm wastes, *Cattle, *Lagoons, Kansas, Biochemical oxygen demand, Odor, Dusts, Groundwater, Surface waters, Water pollution, Volume, Value, Soil environment, Temperature, Biodegradation, Anaerobic conditions, Mixing, Depth, Stabilization, Organic matter, Color, Nitrogen, Ammonia, Coliforms, Alkalinity, Hydrogen ion concentration, Equilibrium, Waste water treatment.
Identifiers: *Feedlots, *Anaerobic lagoons, Population equivalent, Slug load, Lagoon operation, Biological system, Surface area/volume ratio, Loading parameters, Volatile solids, Detention times.

Even under ideal equilibrium conditions, the liquid effluent from anaerobic lagoons treating livestock and feedlot wastes could pollute a receiving body of water. The quality of the effluent is decreased during the startup operations. The effluent is high in oxygen-demanding material, solids, and nitrogen. Subsequent treatment units are advisabl to remove the solids and most of the oxygen-de manding material. Seasonal temperature variation will alter the effluent quality. The settled solids tha need to be removed periodically from the anaero bic lagoon undergo considerable degradation, sta bilization, and concentration. They are less poten than the entering untreated solids. However, thei quality is such that they should not enter receivin waters. Land disposal offers an acceptable metho of disposal for these solids. Anaerobic lagoons ar not the complete answer to avoiding the pollutio of natural waters by livestock and feedlot waste When used in combination with subsequent units t treat the effluent from the lagoons, anaerobi lagoons may be useful component process fo livestock and feedlot wastes that have a high solid content. (White-Iowa State)
W71-05423

DISPOSAL OF DAIRY MANURE,
Massachusetts Univ., Amherst. Dept. of Agricu tural Engineering.
Curtis A. Johnson.
Transactions of the American Society of Agricu tural Engineers, Vol 8, 1965, p 110-112. 3 fig, 1 ref.

Descriptors: *Farm wastes, *Cattle, *Septic tank Poultry, Fertilizers, Economics, Aesthetics, Eff ciencies, Dusts, Evaluation, Value, Lagoons, Wate pollution, Odor, Pumps, Methane, Anaerobi digestion, Aeration, Effluent, Recirculated wate Irrigation, Aerobic treatment, Waste water trea ment.
Identifiers: *Scraper, *Dairy cattle, Manur production, Effectiveness, Push-button operation Potential, Fly production, Appearance, Noise Aerobic pond, Decomposition, Populatio equivalents, Agitation.

Heated septic tanks, adapted to recirculation of e fluent, hold promise for efficient fluid handling manure and other dairy wastes with minimum labo costs and reasonable structural costs. Effluent fro a three chambered, heated septic is pumped manure gutters behind specially designed stall The effluent provides enough pressure to force scraper the length of the gutter, thus pushing th accumulated manure to the septic tank. Gener design criteria are given. An evaluation scale developed for qualitative evaluation of variou manure handling systems. (White-Iowa State)
W71-05424

THIN SPREADING OF SLURRIED MANURES,
California Univ., Davis. Dept. of Agricultural E gineering.
Samuel A. Hart.
Transactions of the American Society of Agricu tural Engineers, Vol 7, 1964, p 22-28. 9 fig, 3 ta 21 ref.

Descriptors: *Farm wastes, *Slurry, *Drying, Ca tle, Hogs, Poultry, Moisture content, Viscosit Pumps, Bulk density, Volume, Nitrogen, Odor, O ganic matter, Carbon dioxide, Waste water trea ment.
Identifiers: *Spreading, *Thin spreadin *Fluidization, Liquefaction, Solids per cent, F breeding, Slump, Layers, Layer thickness, Surfac area.

The purpose was to determine how thick a layer manure could be spread, day after day, layer upo layer, and still prevent fly breeding or other sanit tion problems. Chicken and dairy manure w fluidized to 10 to 20 percent solids, and then spre in layers on two sets of six plots. The six plots each series were dosed with increasing thickness of manure: from 1/25 to 1/4 inch for the chicke plots; 1/20 to 3/10 inch for the dairy plots. specific plot received the same dose at each of th 47 applications. At a solids content of 85 percen fly breeding was prevented. A significant amount organic matter is lost during drying and storage, th loss being related to the moisture content of th

ot. One-half of the nitrogen originally present in e manure is also lost. The land area needed for mulative layering is not large - less than 200 sq. per cow and 1 sq. ft. per chicken. Odors can and occur in manure thin spreading, but can be nimized by layering of fresh manure only. Vhite-Iowa State)
71-05425

OW WE HANDLE LIQUID MANURE,

oard's Dairyman, Vol 109, November 25, 1965, p 54-1255, 1280-1281. 14 fig, 1 tab.

escriptors: *Farm waste, *Cattle, *Storage tanks, rry, Costs, Volume, Age, Construction, oisture content, Odor, Pumps, Electric power, pellers, Nutrients, Waste water treatment.
entifiers: *Dairy cattle, *Liquid manure system, ee stall housing, Agitation, Tank spreader, Fly eeding.

ve top dairymen are interviewed about their uid manure handling systems. All incorporated rage tanks, and disposal on land with tank readers. Different types of agitation and pumping ethods are explained. The systems ranged in cost m $3250 to $7800, or from $35 to $52 per cow. is included storage tank, agitation and pumping uipment, and tank spreaders. Several spent up to 600 for concreting the barnyards. The tanks ried in capacity from 18,000 to 75,000 gallons, d were emptied as often as once a week to once ery two months. The need for added moisture is cussed as well as fly and odor problems. Some advantages are given, the major one being the h capital investment. (White-Iowa State)
71-05426

EROBIC DIGESTION (COMPOSTING) OF OULTRY MANURE,

Livshutz.
orld's Poultry Science Journal, Vol 20, 1964, p 2-215. 1 fig.

escriptors: *Farm wastes, *Poultry, *Aerobic atment, Aeration, Plastics, Plastic pipes, Width, pth, Length, Volume, Pressure, Moisture, Temrature, Aerobic bacteria, Oxygen, Odor, drogen ion concentration, Moisture content, mpaction, Waste water treatment.
entifiers: *Composting, *Windrow method, stic sheets, Pressure blower, Forced-air system, composition, Fly breeding, Carbon-nitrogen io, Oxidizing atmosphere.

e article describes a windrow method of comsting in which a pressure blower forces air ough lateral 3/4 inch diameter pipes. The pipes ve four rows of about 15 holes, each one to two n. diameter. The windrow, up to 50 meters long d 3 meters wide, is covered with a plastic sheet. ne advantages of the aeration system are given. e plastic covering may eliminate turning of winws, by preventing the upper layers of the comsting material from drying out. The carbonrogen ratio should be around 25-30:1 with a pH about 7. Optimum moisture should be about 50 cent. After about two weeks of composting, deending on the material and climatic conditions, manure is sterilized, odorless and dry and can used profitably for agricultural purposes. hite-Iowa State)
71-05427

ASTES FROM PIG PRODUCTION UNITS,

y River Purification Board (Scotland); and rth of Scotland Coll. of Agriculture, Aberdeen. ottish Farm Buildings Investigation Unit.
A. Pontin, and S. H. Baxter.
ater Pollution Control, Vol 67, No 6, 1968, p 2-638. 4 tab, 4 fig, 11 ref.

escriptors: *Farm wastes, *Hogs, *Activated dge, Foaming, Freezing, Rotors, Effluent, ochemical oxygen demand, Odor, Construction, Rubber, Linings, Recirculated water, Operations, Slurries, Sludge, Dissolved oxygen, Costs, Aeration, Water pollution, Public health, Lagoons, Anaerobic digestion, Filtration, Waste water treatment.
Identifiers: *Oxidation ditch, Slatted floor, Primary ditch, Secondary ditch, Suspended solids, Layout, Rubber sheeting, Continuous operation, Intermittent operation, Land disposal, Composting, Extended aeration.

Methods for the disposal or treatment of the increasing quantities of slurry from intensive pig production units are outlined. The possible application of the oxidation ditch for such treatment is discussed and the results of experiments of a commercial piggery are described. The authors conclude that the method offers the promise of an economic solution but that further research is urgently needed. (White-Iowa State)
W71-05428

LAGOONS FOR LIVESTOCK MANURE,
California Univ., Davis.
Samuel A. Hart, and Marvin E. Turner.
Journal Water Pollution Control Federation, Vol 37, No 11, November 1965, p 1578-1596. 5 tab, 6 fig, 9 ref.

Descriptors: *Farm wastes, *Poultry, *Cattle, *Hogs, *Lagoons, Stabilization, Biochemical oxygen demand, Anaerobic conditions, Sewage, Aerobic conditions, Odors, Volume, Sludge, Nitrogen, Phosphorus, Potassium, Chemical oxygen demand, Ammonia, Physical characteristics, Chemical characteristics, Hydrogen ion concentration, Alkalinity, Scum, Color, Opacity, Earth-water interfaces, Infiltration, Anaerobic digestion, Waste water treatment.
Identifiers: *Loading rates, *Physical appearance, Surface area, Total solids, Volatile solids, Volatile acids, Fly activity, Crusting, Pilot lagoons, Materials balance, BOD reduction, Sludge seed.

The need for more closely controlled tests of a laboratory type concerning livestock manure lagoons prompted this study. Eight concrete ringed pilot lagoons four feet in diameter and seven feet were used in the experiment. The units were fed poultry, dairy and cattle manure during the two year test. Chemical and physical properties were monitored weekly and are presented in tabular form. Infiltration from the packed earth bottom was considerable. This hampered the accurate determinations needed for a materials balance. Appearance, odors, and fly activity were noted. A section tells how to use the knowledge gained from the experiment. It is felt that with proper construction, property loading rates, and proper operation, lagoons can be expected to be satisfactory. (White-Iowa State)
W71-05429

TREATMENT OF LIVESTOCK WASTE -- A LABORATORY STUDY,
Missouri Univ., Columbia. Dept. of Sanitary Engineering; and Missouri Univ., Columbia. Dept. of Agricultural Engineering.
E. A. Jeffrey, W. C. Blackman, and Ralph Ricketts.
Transactions of the American Society of Agricultural Engineers, Vol 8, No 1, 1965, p 113-117, 126. 6 fig, 5 tab, 17 ref.

Descriptors: *Farm wastes, *Lagoons, *Anaerobic digestion, *Hogs, Aerobic treatment, Lagoons, Cattle, Sheep, Aeration, Sludge, Domestic wastes, Hydrogen ion concentration, Digestion tanks, Biochemical oxygen demand, Chemical oxygen demand, Waste dilution, Nitrification, Manometers, Design standards, Design criteria, Waste water treatment.
Identifiers: *Aerobic lagoon, Agitation, Volatile solids, Total solids, Beuch scale aerators, BOD/COD ratio, Detention time.

A study was made of the aerobic and anaerobic digestion characteristics of livestock wastes. The results obtained in the hog waste digestion studies are compared to design criteria for domestic sludge digestion units. Design loading conditions and water requirements are calculated for using an anaerobic lagoon for treating hog wastes. Design requirements for an aerobic lagoon are also indicated. It is concluded that disposal of hog wastes by use of aerobic lagoons is prohibitive because of the large requirements of both water and land area. The use of anaerobic lagoons is feasible, but it is accompanied by the problem of eventually having to dispose of the accumulated digested sludge. Future studies should be made on the operation of series lagoons. By using the first lagoon for settling and as an anaerobic lagoon, the area requirement of the second to serve as an aerobic lagoon would be greatly reduced, perhaps to the point of practicality. (White-Iowa State)
W71-05430

MECHANICAL CLEANING OF COWSHEDS,
Agricultural Land Service, Leeds (England).
J. N. Addison.
Agriculture, Vol 77, No 11, November 1970, p 534-536.

Descriptors: *Farm wastes, Cattle, On-site data collection, Age, Costs, Specifications, Depth, Width, Length, Slopes, Ponding, Maintenance, Waste water treatment.
Identifiers: *Dairy cattle, *Mechanical cleaners, *England, Continuous type, Shuttle type, Cow sheds, Blades.

Twenty-one cowsheds on eighteen farms were surveyed to establish the extent to which mechanical channel cleaners had been installed, their age, condition, costs, and reasons for their installation in the first place. Problems with the mechanical cleaners are discussed as well as design specifications. The cost per cow of the shuttle type cleaner was found to be about 21 pounds and that of the continuous type 18 pounds. (White-Iowa State)
W71-05431

TREATMENT OF FARM EFFLUENTS,
Water Pollution Research Lab., Stevenage (England).
A. B. Wheatland, and B. J. Borne.
Chemistry and Industry, February 29, 1964, p 357-362. 5 tab, 7 ref.

Descriptors: *Farm wastes, *Cattle, *Hogs, *Waste water treatment, Surface runoff, Volume, Water pollution, Biochemical oxygen demand, Cooling water, Carbon, Nitrogen, Nitrate, Effluents, Sewage, Filtration, Irrigation, Farm ponds, Silage, Organic matter, Biological treatment, Septic tanks.
Identifiers: *England, *Dairy cattle, Pollutional strength, Milking parlors, Permanganate, Recirculation, Land disposal, Soakaways, Chemical treatment.

Sources, volumes, and strength characteristics of farm effluents are discussed. A major portion deals with dairy and waste water effluents, coming from milking parlors and holding pens. Chemical and physical properties are listed in tabular form. Hog wastes and silage liquor are mentioned briefly as effluent sources. Treatment methods discussed include disposal on land, discharge to a sewer, biological treatment, septic tanks and chemical treatment. Disposal on land may be accomplished by use of tankers, soakaways, or irrigation. The use of storage ponds facilitates the latter. (White-Iowa State)
W71-05432

FUMIGATION AND REUSE OF BROILER LITTER,
Hawaii Univ., Honolulu. Dept. of Animal Sciences.
Ernest Ross.
Poultry Science, Vol 47, 1968, p 1711-1712.

Descriptors: *Farm wastes, *Poultry, *Fumigants, Broods, Performance, Mortality, *Waste treatment.

Identifiers: Weight gains, Feed conversion, Reused litter, Litter, Methyl bromide.

A series of experiments was conducted to compare the performance of broiler chicks reared on fresh and reused wood shavings litter. In addition, the effect of methyl bromide fumigation of reused litter on subsequent chick growth, feed conversion and mortality was studied. Non-fumigated fresh and reused litters served as controls. Methyl bromide fumigation reduced the total bacterial population of reused litter. This reduction, however, did not result in any significant improvement in body weight gains, feed conversion or mortality. The performance of the chicks reared on the fumigated litter was similar to that of chicks reared on reused litter and slightly superior to that of chicks reared on fresh wood shavings litter. The mortality o f chicks reared on fresh litter was slightly lower than in the groups on the reused litters. (White-Iowa State)
W71-05434

CONFINED SWINE MANURE DISPOSAL,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Robert A. Bella.
Master of Science Thesis, 1968. 157 p, 37 fig, 47 ref. OWRR Project A-011-KAN (2).

Descriptors: *Farm wastes, *Pigs, Aerobic conditions, Oxygen requirements, Waste water treatment, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Waste disposal.
Identifiers: *Swine wastes, *Oxidation ditch, Rotor capacity.

The object was the evaluation of an oxidation ditch for the treatment of swine manure. The oxidation ditch was constructed as part of the foundation for each building. Slotted floors permitted the manure to discharge directly from the animal into the treatment unit. Data were collected at weekly intervals from September, 1966 to August, 1967. The data indicated that the oxidation ditch could treat swine manure without odor nuisances. These units were able to reduce the soluble BOD to less than 10 milligrams per liter with a total effluent BOD of about 1,200 milligrams per liter. The effluent also contained considerable salts in addition to the suspended solids. It was necessary that the treated effluent be discharged into cultivated fields rather than being discharged into the adjacent drainage ditch. A holding pond was used to store the discharge of the treated effluent prior to spreading on nearby fields. (Miner-Iowa State)
W71-05435

AGRICULTURAL PRACTICES AND WATER QUALITY.
For primary bibliographic entry see Field 05B.
W71-05437

LIVESTOCK OPERATIONS AND FIELD-SPREAD MANURE AS SOURCES OF POLLUTANTS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W71-05438

MANURE DECOMPOSITION AND FATE OF BREAKDOWN PRODUCTS IN SOIL,
Department of Agriculture, Lincoln, Neb.; and Iowa State Univ., Ames.
For primary bibliographic entry see Field 05B.
W71-05439

MANURE TRANSFORMATIONS AND FATE OF DECOMPOSITION PRODUCTS IN WATER,
Kansas Univ., Lawrence. Dept. of Civil Engineering
For primary bibliographic entry see Field 05B.
W71-05440

ANIMAL WASTE MANAGEMENT TO MINIMIZE POLLUTION,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W71-05442

ION EXCHANGE OF WASTE WATER FROM THE FOODSTUFF INDUSTRY,
Royal Danish School of Pharmacy, Copenhagen. Chemical Lab. A.
Sv. E. Jorgensen.
Vatten, Vol 4, p 350-357, 1970. 6 tab, 2 fig, 11 ref.

Descriptors: *Waste water treatment, *Precipitation, *Ion exchange, *Organic matter, Proteins, Phosphates, Nitrates, Carbohydrates.
Identifiers: *Polypeptides, *A-amino groups, *Foodstuff industry waste treatment.

A purification process for waste water from foodstuff industries by precipitation with glucose trisulphate and three ion exchangers was analyzed and is described. Proteins with high molecular weight were removed and the number of free a-amino groups are reduced by precipitation. The first ion exchanger also removes proteins but the substantial reduction of the number of a-amino groups is done by a cationic exchanger. This ion exchanger removes polypeptides of lower molecular weight and ammonia. A chelated anionic exchanger then removes low molecular polypeptides, phosphates, nitrates and carbohydrates. Eperimental conditions, and analytical methods for the ion exchange processes and elution are described in detail. (Ensign-PAI)
W71-05509

FUNGI ASSOCIATED WITH THE ACTIVATED-SLUDGE PROCESS OF SEWAGE TREATMENT AT THE LEBANON, OHIO, SEWAGE-TREATMENT PLANT,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Research Lab.
William Bridge Cooke.
The Ohio Journal of Science, Vol 70, No 3, p 129-146, May 1970. 2 fig, 8 tab, 11 ref.

Descriptors: *Pseudomonas, *Yeasts, *Activated sludge, *Sewage treatment, Ohio, Cultures, Hydrogen ion concentration, Dissolved oxygen, Biochemical oxygen demand, Carbon, Suspended load.
Identifiers: Total organic carbon.

Samples of materials in various stages of sewage treatment were obtained at monthly intervals between October, 1967, and April, 1968, from the Lebanon, Ohio, sewage-treatment plant. A total of 93 species or species groups of fungi, including filamentous and yeast-like types, was recovered from both secondary and tertiary processes. Sampling and isolation techniques and data for several chemical and physical measurements made on the samples are presented. Effluent from the activated sludge aerator contained a ratio of 41 bacteria to one fungus, in contrast to a ratio of 1430 bacterial cells to one fungus cell in raw sewage. (Little-Battelle)
W71-05624

NTA,
Children's Cancer Research Foundation, Inc., Boston. Lab. of Environmental Toxicology; and Children's Cancer Research Foundation, Inc., Boston. Lab. of Carcinogensis.
For primary bibliographic entry see Field 05C.
W71-05639

GEOMETRIC PROGRAMMING AND THE PRELIMINARY DESIGN OF INDUSTRIAL WASTE TREATMENT PLANTS,
Rensselear Polytechnic Inst., Troy, N.Y. Dept. of Mathematics; and Union Coll., Schenectady, N.Y. Dept. of Economics.
J. G. Ecker, and J. R. McNamara.
Water Resources Research, Vol 7, No 1, p 18-22, February 1971. 5 p, 3 tab, 5 ref. NSF grant GP 15031.

Descriptors: *Optimization, *Dynamic programming, *Industrial wastes, *Waste treatment, *Design, Water quality, Cost, Stream improvement.
Identifiers: *Geometric programming.

The use of a new optimization theory termed 'geometric programming' was compared to the use of dynamic programming for preliminary design of industrial waste treatment plants. In a recent paper Shih and Krishnan used a dynamic programming approach to designing a waste treatment plant operating on pulp and paper manufacturing wastes that provided a required effluent quality in terms of percent of 5-day (first stage) biochemical oxygen demand (BOD) removed at minumum total annual cost. This cost, assumed constant over time, was composed of construction amortization costs, insurance costs, and operation costs. Then the geometric programming was proposed which used Program A in association with program B forming a 'dual' program relationship where one program was studied through properties of the other. Since the optimal value of program A equaled the optimal values, of B, finding a minimizing vector for program A relied on solving program B first. For the design problem under consideration, the dual program B was solved by associating it with various designs. Detailed calculation for design 1, a combination of four processes in series: primary clarification, trickling filter, activated sludge with secondary clarification, and carbon adsorption, illustrated the procedure. It was shown that geometric programming plays an important role in large stream quality problems. (Kriss-Cornell)
W71-05680

DISPOSAL OF WASTES FROM SWINE FEEDING FLOORS TO MINIMIZE STREAM POLLUTION,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
W. F. Schwiesow, H. L. Brodie, and H. J. Eby.
Available from NTIS as PB-198 028, $3.00 in paper copy, $0.95 in microfiche. Completion Report, University of Maryland, Water Resources Research Center, January 1970. 11 p. OWRR Project A-004-MD (1).

Descriptors: *Farm wastes, *Water pollution sources, *Pigs, *Septic tanks, Digestion tanks, Sedimentation tanks, Soil disposal fields, *Waste disposal, Waste water treatment.
Identifiers: *Flushing gutters, Swine manure.

This research was to investigate the feasibility of a septic disposal system with an underground distribution system as a means of eliminating runoff from swine feeding floors into the surface waters. Installation provided for hydraulic cleaning of the feeding floor. Manure, water and uneaten feed was washed into gutters, one on each side of the house. Modifications included the addition of a 7,000 gallon tank, a 1,200 gallon tank and connecting 4 inch PVC pipe. Six hundred feet of perforated plastic drain lines were located near the tanks. It was soon evident that the large tank intended to serve as a septic tank was inadequate and performed primarily as a sedimentation tank. Data taken showed this tank was satisfactory for accumulating solid wastes for a period of about 5 weeks. Solids were removed by mechanical means. Tests on the tile distribution system showed that the capacity to dispose of the liquid effluent was more than needed. Proper operation should provide a satisfactory means of disposing of the liquid portion of the wastes without polluting the nearby river. (Miner-Iowa State)
W71-05738

A REPORT ON THREE MANURE COMPOSTING PLANTS,
Public Health Service, San Francisco, Calif.
John S. Wiley.

mpost Science, Vol 5, Summer 1964, p 15-16. 3

escriptors: *Farm wastes, Public health, Cattle, ultry, Organic wastes, Aerobic conditions, naerobic conditions, Mositure content, Aeration, lor, Pathogenic bacteria, Screens, Nitrogen, Amnia.
ntifiers: *Composting, *Aerobic decomposin, Nuisance, Fly production, Windrow compost-, Rotary drum composter, Soil conditioner.

e article describes three manure composting nts which process manure in a sanitary, nomical manner and use the product as a soil nditioner. One plant treats a mixture of feedlot nure from 5500 steers and meat packing wastes long windrows which are turned six times during six week composting period. The other two nts treat poultry manure in rotary drum comsters. Each of these two plants treats wastes from million birds. The compost is sold as a humus nt food. The three plants are interesting atnpts to process manures in a sanitary manner d to utilize the resulting product for the benefit he soil. (White-Iowa State)
71-05739

FECTS OF ORGANIC MANURES ON SOILS D CROPS,
ading Univ. (England). Dept. of Agricultural tany.
H. Bunting.
oceedings Nutrition Society, Vol 24, No 1, p 29-, 1965. 4 tab, 14 ref.

scriptors: *Soils, *Crops, *Organic matter, Ferzers, Farm wastes, Nitrogen, Phosphorus, Potasm, Crop production, Nutrients, Wheat, tatoes, Sewage sludge, Calcium, Fertility, Temrature, Moisture content, Soil structure.
ntifiers: *Farmyard manure, *Organic manures, neral fertilizers, Sludge compost, Minor elents.

e paper reports on the effects organic manure, d especially farmyard manure, has on different ls and crops. The effects of organic manures on ps are often important, but they are largely asciated with changes in the supply of nutrients. wever, there is good evidence that on some spel soils, they have special effects on crop growth. e paper then focuses on changes which take ce in the soil as a result of organic matter addin. Moisture content and soil structure are most rticularly affected. (White-Iowa State)
71-05740

ALUATION OF SEVERAL METHODS OF OLATING SALMONELLA FROM POULTRY TTER AND ANIMAL FEEDSTUFFS,
ssachusetts Univ. Amherst. Dept. of Veterinary d Animal Sciences.
F. Smyser, and G. H. Snoeyenbos.
ian Diseases, Vol 13, No 1, p 134-141, 1969. 5 , 13 ref.

scriptors: *Salmonella, *Poultry, Bacteria, Farm stes, Microorganisms, By-products, Incubation, mpling, Frequency.
ntifiers: *Poultry litter, *Feedstuffs, Enrichment oths, Selenite broth, Animal by-products, Feed ls, Rendering plants, Tetrathionate broth, Sigicant difference, Proteus.

comparison of several different culture ocedures for Salmonella isolations, using enite-brilliant green-sulfapyridine (SBG sulfa) d tetrathionate brilliant green (TBG) as enhments was made with 198 litter samples of ich 161 were positive by one or more methods, d with 371 animal feedstuff samples of which d were positive by one or more methods. All enhments were streak-plated after 48 hour incuban. SBG sulfa incubated at 43C was superior to G sulfa at 37C, and to TBG at 37C with or hout pre-enrichment for the isolation of salmonellae from poultry litter and animal feedstuffs. Significantly more samples of animal feedstuffs yielded salmonellae from SBT sulfa at 43C than from the other two media. More salmonella colonies and fewer competing organisms were usually obtained on BG agar plated from SBG sulfa at 43C than from either SBG sulfa at 37C or TBG. SBG sulfa appeared to be a more favorable enrichment medium than TBG for isolating S. senftenberg; differences in the number of isolations among several other serotypes were too small for comparison. (White-Iowa State)
W71-05741

CHEMICAL AND BIOLOGICAL REACTIONS FROM LAGOONS USED FOR CATTLE,
Wisconsin Univ., Madison.
S. A. Witzel, Elizabeth McCoy, and Richard Lehner.
ASAE Paper No 64-417. Transactions of the American Society of Agricultural Engineers, Vol 8, p 449-451, 1965. 1 fig, 16 ref.

Descriptors: *Oxidation lagoons, *Biochemical oxygen demand, *Anaerobics, Algae, Bacteria, Water pollution sources, Odor, Farm waste, Sludge, Solid wastes, Decomposting organic matter, Lagoons, Cattle.
Identifiers: Organic nitrogen, Bacteriological study, Aerobicity.

An experimental lagoon to receive the wastes as liquid manure from six bulls was constructed. In an experimental barn the manure from the bulls was washed daily into two gutters 24 in. wide at the top. The gutters had a capacity of 2000 gallons. The gutters were flushed every seven days into a lagoon. The circular lagoon had a 60 ft diameter at the top, a 40 ft diameter at the bottom and was 5 ft deep. Liquid manure samples were taken from the barn gutter and from the lagoon manure liquid and sludge. BOD tests were conducted on all samples and the percent BOD reduction from gutter to lagoon was calculated. Other tests were made to determine percent total solids removal, organic nitrogen content, pH values, and temperature. Extensive tests were made and reported on bacteria content, both quantitative and qualitative. Five conclusions of the study are mentioned. (Parker-Iowa State)
W71-05742

ARTHROPOD PREDATORS OF IMMATURE DIPTERA DEVELOPING IN POULTRY DROPPINGS IN NORTHERN CALIFORNIA: PART I,
California Univ., Berkeley. Dept. of Entomology and Parasitology.
John H. Peck, and John R. Anderson.
Journal Medical Entomology, Vol 6, No 2, p 163-167, May 31, 1969. 4 tab, 19 ref.

Descriptors: *Poultry, *Diptera, Farm wastes, Biocontrol, Sampling, California, Seasonal, Mosture content, Animals, Mites.
Identifiers: *Arthropod predators, Fly control, Filth flies, Cohabitation, Poultry droppings, Predatory fauna, Coleoptera, Enumeration.

Arthropod predators occurring in manure at 2 Sonoma County, California, poultry ranches were identified and studied. Seasonal abundance and association with prey were determined for the following major predators: Macrocheles muscaedomesticae, Glyptholaspis confusa, Fuscuropoda sp., Carcinops pumilio, Margarinotus merdarius, Philonthus politus, P. sordidus, Staphylinus maxillosus villosus, Muscina stabulans, and Ophyra leucostoma. (See also W71-05744). (White-Iowa State)
W71-05743

ARTHROPOD PREDATORS OF IMMATURE DIPTERA DEVELOPING IN POULTRY DROPPINGS IN NORTHERN CALIFORNIA: PART II,
California Univ., Berkeley. Dept. of Entomology and Parasitology.
John H. Peck.
Journal Medical Entomology, Vol 6, No 2, p 168-171, May 31, 1969. 4 tab, 15 ref.

Descriptors: *Poultry, *Diptera, California, Seasonal, Predation, Mites, Mortality, Insect eggs, Larvae, Light, Farm wastes.
Identifiers: *Arthropod predators, Predation potential, Media cohabitation, Pupae, House fly eggs, Variance, Poultry droppings.

The feeding responses of 3 species of predaceous Staphylinidae and 2 species of predaceous Histeridae were studied by exposing them to eggs, larvae and pupae of Musca domestica and Fannia femoralis. Studies of age-of-prey specific predation by M. muscaedomesticae on immature M. domestica showed that most mortality was inflicted on eggs and first instar larvae. Predation rates were determined for the above and 6 other predaceous species; the following indices of predation potential were computed for the 5 most abundant predators: Fuscuropoda sp. (adults) - 3.5, Glyptholaspis confusa females - 4.4, Macrocheles muscaedomesticae females - 95.8, Carcinops pumilio (adults) - 97.0, and Ophyra leucostoma L3 - S226.4. The potential importance of the above predators is discussed with reference to their seasonal and media cohabitation with various prey species. (See also W71-05743). (White-Iowa State)
W71-05744

TWO BILLION TONS OF - WHAT,
Department of Agriculture, Beltsville, Md. Livestock Engineering and Farm Structures Research Branch.
Harry J. Eby.
Compost Science, Vol 7, p 7-10, Autumn 1966. 2 fig.

Descriptors: *Farm wastes, *Volume, *Organic wastes, Domestic wastes, Cattle, Poultry, Nutrients, Value, Organic matter, Topsoil, Turf, Water pollution, Percolation, Fertilizers, Filters.
Identifiers: *Waste production, *Grass belts, *Composting, Population equivalent, Land disposal, Pollution control.

The author advocates managing our millions of tons of organic waste, both farm and municipal, in such a way that grass belts would be planted along the borders of streams and rivers. The organic wastes would be worked into these areas in large quantities to improve the quality of the soil. His proposal is based on three factors: (1) Soil with a high organic content holds more water than soils with little organic content. (2) Incorporating organic matter into a clay soil improves its percolation rate as well as its water-holding capacity. (3) Soil is a good bacterial filter. Thus the grass belts would act as a means of stream and river pollution control. The author feels that more research is needed to find components of manure which would have continuing industrial or commercial applications. Examples are given illustrating the magnitude of the animal waste disposal problem. (White-Iowa State)
W71-05745

FARM WASTES.

Proceedings of Symposium, Farm Wastes, The Institute of Water Pollution Control, The University of Newcastle upon Tyne, 1970. 148 p.

Descriptors: *Farm wastes, Disposal, Legislation, Slurries, Composting, Disease, Legal aspects, Hazards, Toxicity, Public health, Odors, Costs, Design criteria, Treatment, Adsorption, Reverse osmosis, Confinement pens, Hogs, Equipment, Microorganisms, Farm lagoons, Irrigation, Aeration, Aerobic treatment, Anaerobic treatment, Biochemical oxygen demand, Chemical oxygen demand, Biological treatment.

Identifiers: Health, Public nuisance, Population equivalents, Swine, Slatted floors, Oxidation ditch, Flushing gutter, Systems, Gas production, United Kingdom.

The two day symposium was attended by over 200 delegates including representatives from local authorities, river authorities, universities, agricultural colleges and research stations, nationalized industries and consultants. The various Ministries were well represented, with over 60 delegates. Those attending included delegates from Canada, Denmark, Eire, Holland and the United States. Nineteen technical papers were presented. A discussion of each paper is included. Four sessions were conducted: An introductory session, 4 papers; Problems off the farm, 3 papers; Minimizing the waste problem, 7 papers; and Waste treatment and disposal on the farm, 5 papers. (See also W71-05748 thru W71-05766). (Christenbury-Iowa State)
W71-05747

THE PROBLEM OF DISPOSAL OF FARM WASTES, WITH PARTICULAR REFERENCE TO MAINTAINING SOIL FERTILITY,
National Agricultural Advisory Service, Bristol (England). Soil Science Dept.
C. Berryman.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne, Paper No 3, p 19-23, 1970. 4 tab, 4 ref.

Descriptors: *Disposal, *Slurries, *Fertility, Farm wastes, Anaerobic conditions, Nutrients, Irrigation, Value, Fertilizers, Waste disposal.
Identifiers: *Animal slurry, *Composition, Organic irrigation.

This paper reviews the effect of farm waste, particularly in the form of animal slurry, on soil fertility. Slurry can supply an important part of the NPK requirements on the farm. The application of slurry to land is the most convenient and practical method of disposal, but problems due to a breakdown of soil structure can occur if an unsuitable soil receives excessive applications of slurry. The soil type is important when assessing the effect slurry disposal will have on the fertility of soil. (See also W71-05747). (Christenbury-Iowa State)
W71-05750

SEWERS AND SEWAGE TREATMENT,
Chartered Civil Engineers, London (England); Newcastle-upon-Tyne Univ. (England).
James R. Simpson, and R. L. Hibberd.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne, Paper No 7, p 44-51, 1970. 2 fig, 2 tab, 13 ref.

Descriptors: *Costs, *Design criteria, *Sewage treatment, Farm wastes, Biochemical oxygen demand, Legislation, Dissolved solids, Tertiary treatment, Sewers, Activated sludge, Capital cost.
Identifiers: River authority, Loading rates, Mogden formula, United Kingdom, Population equivalents, Suspended solids.

The purpose of this paper is to aquaint those unfamiliar with sewerage and sewage treatment with the general nature of the systems and processes. References to more detailed descriptions of the processes are included. Further, an attempt is made to answer the questions, 'Why and to what extent would a discharge with given characteristics affect the design of the sewers and the sewage-treatment works, and at what cost.' A formula for allocating waste treatment cost to agriculture is discussed. A discussion of the paper is included. (See also W71-05747). (Christenbury-Iowa State)
W71-05754

MINIMIZING THE WASTE DISPOSAL PROBLEM IN VEGETABLE PROCESSING,
Electricity Council Research Center, Capenhurst (England).
F. Barrett.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No 8, p 57-65. 7 fig, 4 tab.

Descriptors: *Apparatus, *Adsorption, *Reverse osmosis, Farm wastes, Desalination, Chemical oxygen demand, Recirculated water, Aeration, Flotation, Chlorination, Ultraviolet radiation, Biochemical oxygen demand, Equipment, Ozone, Biological treatment, Sludge disposal, Treatment.
Identifiers: *Food processing, Sterilization, Ozonation, United Kingdom, Vegetable processing.

This paper discusses possible mentods of treating waste from vegetable processing plants. The results obtained from a coagulation/flocculation unit have been encouraging. An aeration tower complex has been utilized for biological treatment. A pilot-scale adsorption unit and a reverse osmosis unit have been designed, built, and evaluated. A discussion and the reply to the discussion follows on page 106-109. (See also W71-05747) (Christenbury-Iowa State)
W71-05755

MINIMIZING POULTRY WASTE PROBLEMS,
National Agricultural Advisory Service, London (England).
C. T. Riley.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No 9, p 66-72. 3 fig, 5 tab, 1 ref.

Descriptors: *Farm wastes, *Poultry, *Disposal, Costs, Biochemical oxygen demand, Odor, Land use, Sludge, Chemical properties, Physical properties, Fertilizers.
Identifiers: Composition, Hatchery waste, Broilers, United Kingdom.

This paper is divided into two parts; first an assessment of the industry and second an approach to some current problems. Manure from cage layers represents the major disposal problem in the poultry industry today. The physical and chemical properties of waste is given. In the main, poultry waste has to be returned to the land in some form. The disposal of manure from laying batteries is discussed in relation to minimizing the poultry-waste problems. Whether to handle the manure as a solid or liquid is examined. A discussion and reply to the discussion follows on page 106-109. (See also W71-05747) (Christenbury-Iowa State)
W71-05756

MINIMIZING THE WASTE PROBLEM WITH PIGS,
National Agricultural Advisory Service, London (England).
C. G. Pointer.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No 10, p 73-80. 7 fig.

Descriptors: *Confinement pens, *Design standards, *Hogs, Farm wastes, Slurries, Odor, Cleaning.
Identifiers: *Swine, Slatted-floor, Slurry systems, Sow feeders, Fattening house, Farrowing, United Kingdom, Manure handling, 'Ad-lib' feeding.

The first step towards minimizing the problems will be in the choice of site for the new pig unit. The larger the unit the more critical this decision will be. Subsequently the management and housing systems selected must be suited to the site. Systems have been described in this paper which minimize the problems. In existing problem units common sense and discretion can often avoid acute situations developing. It is hoped that economic solutions for these units will be evolved. In any event, there is always likely to be some smell from a piggery. A discussion and the reply to the discussion follows on page 106-109. (See also W71-05747) (Christenbury-Iowa State)
W71-05757

MINIMIZING THE WASTE PROBLEM WITH CATTLE,
Newcastle-upon-Tyne Univ. (England).
M. M. Cooper.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No 11, p 81-83.

Descriptors: *Farm wastes, *Slurries, *Disposal, Cattle, Costs, Confinement pens.
Identifiers: *Cubicle system, Cowtels, United Kingdom.

This paper discusses some of the changes taking place in the cattle industry and the requirements for waste disposal. Many cattle producers require confinement areas for cattle for at least part of the year. Some of the systems being utilized for waste disposal are discussed. A discussion and the reply to the discussion follows on page 106-109. (See also W71-05747) (Christenbury-Iowa State)
W71-05758

BUILDING DESIGN,
Chartered Architects, London (England).
J. B. Weller.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No. 12, p 84-93. 2 fig, 6 tab.

Descriptors: *Farm wastes, *Cost comparisons, *Disposal, Management, Slurries, Design criteria, Gases, Farm lagoons, Buildings, Storage tanks, Storage capacity, Livestock, Treatment.
Identifiers: United Kingdom, Slatted floors, Perforated floor, Cubical-house, Bacon house.

This paper discusses some design criteria for animal housing. The first portion of the paper deals with the management factors that must be considered, such as type of manure, quantity, disposal method, bedding, and cost. The remainder of this paper examines some of the implications regarding actual building types. There is a comprehensive table giving the definitions and requirements for the management of slurry and manure from livestock. A cost analysis of the various possible disposal systems is presented. A discussion and the reply to the discussion follows on page 106-109. (See also W71-05747) (Christenbury-Iowa State)
W71-05759

BUILDING DESIGN AND MANURE DISPOSAL,
Institutt voor Landbouwbedrijfsgebouwen, Wageningen (Netherlands).
J. C. Glerum, A. P. S. De Jong, and H. R. Poelma.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No 13, p 94-100. 3 fig, 3 tab.

Descriptors: *Farm wastes, *Disposal, *Costs comparison, Cattle, Storage tanks, Slurries, Storage capacity, Design criteria.
Identifiers: Mucking-out, Mixed storage, Separate storage, Animal housing, Cubicle house.

In general, slurry systems are preferable to system for handling solids and urine separately. Special reasons, for example difficulty in disposing of the manure, can cause separate storage to be used. If mixed storage is used the layout of the building must be adapted to the specific requirements of this system. Altering the buildings afterwards will usually be very expensive. The high capital cost of the slurry system will often be a drawback; this is especially the case for cowhouses where a considerable storage capacity is required. A discussion and the reply to the discussion follows on page 106-109. (See also W71-05747) (Christenbury-Iowa State)
W71-05760

GGERY CLEANING USING RENOVATED ASTES,
wa State Univ., Ames. Dept. of Agricultural En-neering.
J. Smith, T. E. Hazen, and J. R. Miner.
oceedings of Symposium: Farm Wastes: The In-tute of Water Pollution Control and The Univer-y of Newcastle upon Tyne. 1970. Paper No 14, p 1-105. 1 fig, 13 ref. Grant EC 00283.

scriptors: *Disposal, *Equipment, *Oxidation oons, Farm wastes, Design criteria, Confine-nt pens, Management, Recirculated water, aerobic conditions, Slurries, Sludge, Microor-nisms.
ntifiers: *Oxidation ditch, *Flushing gutter, nure removal.

full-scale study of the possibility of renovating ne manure for use in manure transport was car-d out. Preliminary anaerobic treatment and set-g took place in a lagoon followed by secondary atment in an oxidation ditch. Measurements of D, BOD, nitrogen, solids and certain inorganic ts were made during the period February to May 69. Assessment of the results showed that the tem had considerable promise from the stand-nt of confinement house environmental im-ovement and labour reduction. A stable and sani-y effluent was obtained at all times which owed no adverse effects upon the performance of animals exposed to it. Rainfall precluded useful ormation being obtained concerning salt build-or toxicity in the treatment system. No toxicity ects were apparent after continuous operation 20 weeks. The test was terminated because of chanical failures. A discussion and the reply to discussion follows the paper on page 106-109. e W71-05747) (Christenbury-Iowa State)
71-05761

ND DISPOSAL AND STORAGE OF FARM ASTES. 1. PLANNING AND CHOICE OF STEM,
tional Agricultural Advisory Service, London ngland). County Dairy Husbandry Adviser.
J. Quick.
oceedings of Symposium: Farm Wastes: The In-ute of Water Pollution Control and The Univer-of Newcastle upon Tyne. 1970. Paper No 15, p)-115. 1 tab, 6 ref.

scriptors: *Farm wastes, *Disposal, *Effects, rries, Planning, Management, Dry farming, rage, Equipment.
ntifiers: *Systems, *Comparison, Wash water, t farms.

is paper deals with the immediate problems fac-the dairy farmer who finds himself in the nomic squeeze, with the inevitable result that will intensify his dairy enterprise. At the mo-nt there is no universal solution to his problems, they can be tackled, first by identifying the fac-s which will influence the choice of system (by tors are meant soil type, system of cow-housing, unit size) and second, by selecting the most lable system from the available alternatives. e also W71-05763 and W71-05747) (Christen-y-Iowa State)
71-05762

ND DISPOSAL AND STORAGE OF FARM ASTES. 2. HANDLING AND DISTRIBUTION,
tional Agricultural Advisory Service, London ngland). National Livestock Mechanization Spe-list.
Payne.
oceedings of Symposium: Farm Wastes: The In-ute of Water Pollution Control and The Univer-of Newcastle upon Tyne. 1970. Paper No 16, p 5-121. 1 fig, 2 tab, 1 ref.

scriptors: *Farm wastes, *Mechanical equip-nt, *Distribution, Slurries, Disposal, Treatment, rage, Costs, Cattle, Irrigation.
ntifiers: *Handling, Removal, Solid manure, Or-ic irrigation.

The mechanization aspect of applying farm effluent to the land is governed by the physical state of the effluent, the stock housing system and the type of farm on which the stock enterprise is situated. Consequently three basic systems of handling manure onto the land have evolved. These are handling it as a solid manure, as a dense slurry, and as a diluted slurry. This paper discusses the equipment required for each of the handling systems. In general, if the manure can be kept solid the problems will be fewer. (See also W71-05762 and W71-05747) (Christenbury-Iowa State)
W71-05763

AEROBIC TREATMENT OF FARM WASTES,
North of Scotland Coll. of Agriculture, Aberdeen. Scottish Farm Buildings Investigation Unit.
K. Robinson, S. H. Baxter, and J. R. Saxon.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No. 17, p. 122-131. 1 tab, 9 fig, 26 ref.

Descriptors: *Aeration, *Mechanical equipment, *Aerobic treatment, Farm wastes, Odor, Slurries, Ventilation, Farm lagoons, Biochemical oxygen demand, Hogs, Chemical oxygen demand, Microorganisms, Dissolved oxygen, Laboratory tests, Waste water treatment.
Identifiers: Oxidation ditch, Aeration lagoon.

This paper is divided into two main sections - a review of existing commercially available methods of aerobic waste disposal and an outline of the project in Aberdeen for the study of pig-waste treatment. The review is limited to a description of aerobic methods and no specific attempt has been made to compare the relative merits of these systems, since a critical examination of some of them is one of the aims of our project. The characteristics of pig waste, its oxygen demands, and the influences of copper on bacterial activity are discussed. The factors influencing the growth and metabolic activity of micro-organisms are outlined and the problems of satisfactory methods of laboratory determinations are emphasized. (See also W71-05747) (Christenbury-Iowa State)
W71-05764

ANAEROBIC TREATMENT OF FARM WASTES,
West of Scotland Agricultural Coll., Glasgow. Dept. of Bacteriology.
Selwyn Baines.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No. 18, p 132-137. 1 tab, 20 ref.

Descriptors: *Farm wastes, *Anaerobic digestion, Anaerobic conditions, Anaerobic bacteria, Microorganisms, Sludge, Slurries, Mixing, Hydrogen ion concentration, Biochemical oxygen demand, Digestion, Design data, Methane, Waste water treatment.
Identifiers: Commercial applications, Gas production.

This paper describes the effects of anaerobic treatment and its application to farm wastes. A satisfactory methane fermentation can be established and maintained. The digested sludge is relatively inert, free from nuisance and more amendable to dewatering. The anaerobic digestion process also reduces the risk of pathogenic organisms causing human or animal diseases. The design and operation of an anaerobic treatment process is described. Several reports from commercial installations are included. (See also W71-05747) (Christenbury-Iowa State)
W71-05765

TREATMENT OF FARM WASTES,
Instituut voor Landbouwbedrijfsgebouwen, Wageningen (Netherlands).
H. M. J. Scheltinga, and H. R. Poelma.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne. 1970. Paper No 19, p 138-142. 3 tab, 3 fig.

Descriptors: *Farm wastes, *Biological treatment, *Aerobic treatment, Farm lagoon, Activated sludge, Aeration, Slurries, Biochemical oxygen demand, Sludge, Cost comparison, Waste water treatment.
Identifiers: Oxidation ditch, Pasveer ditch.

This paper is related to biological treatment of farm animal waste. Aerobic treatment is described. A schematic of an oxidation ditch and an aeration pit is included. The economic aspect of the oxidation ditch versus the aeration pit is presented. A discussion of the paper is included. (See also W71-05747) (Christenbury-Iowa State)
W71-05766

5E. Ultimate Disposal of Wastes

SLUDGE DUMPING IN THE THAMES ESTUARY,
Ministry of Agriculture, Fisheries and Foods, Burnham-on-Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 05B.
W71-05342

STATE OF THE ART REVIEW ON SLUDGE INCINERATION PRACTICE,
Resource Engineering Associates, Wilton, Conn.
For primary bibliographic entry see Field 05D.
W71-05384

EQUIPMENT FOR DISPOSAL OF AGRICULTURAL EFFLUENTS,
National Agricultural Advisory Service, London (England).
For primary bibliographic entry see Field 05D.
W71-05413

DISPOSAL OF FARM EFFLUENT,
Ministry of Agriculture, Fisheries and Food, Norwich (England). Veterinary Investigation Center.
For primary bibliographic entry see Field 05D.
W71-05414

HARBOR DRIFT DISPOSAL,
Corps of Engineers, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-05514

THE FATE OF INTESTINAL BACTERIA IN THE SEA,
Harvard Univ., Cambridge. Div. of Engineering and Applied Physics.
For primary bibliographic entry see Field 05B.
W71-05527

EFFECTS OF ORGANIC MANURES ON SOILS AND CROPS,
Reading Univ. (England). Dept. of Agricultural Botany.
For primary bibliographic entry see Field 05D.
W71-05740

FARM WASTES.
For primary bibliographic entry see Field 05D.
W71-05747

ORIGINS AND NATURE OF FARM WASTES,
National Agricultural Advisory Service, London (England).
For primary bibliographic entry see Field 05B.
W71-05748

THE PROBLEM OF DISPOSAL OF FARM WASTES, WITH PARTICULAR REFERENCE TO MAINTAINING SOIL FERTILITY,
National Agricultural Advisory Service, Bristol (England). Soil Science Dept.
For primary bibliographic entry see Field 05D.
W71-05750

BUILDING DESIGN AND MANURE DISPOSAL,
Institutt voor Landbouwbedrijfsgebouwen, Wageningen (Netherlands).
For primary bibliographic entry see Field 05D.
W71-05760

LAND DISPOSAL AND STORAGE OF FARM WASTES. 1. PLANNING AND CHOICE OF SYSTEM,
National Agricultural Advisory Service, London (England). County Dairy Husbandry Adviser.
For primary bibliographic entry see Field 05D.
W71-05762

LAND DISPOSAL AND STORAGE OF FARM WASTES. 2. HANDLING AND DISTRIBUTION,
National Agricultural Advisory Service, London (England). National Livestock Mechanization Specialist.
For primary bibliographic entry see Field 05D.
W71-05763

THE COASTAL POLLUTION PROBLEM IN CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05B.
W71-05802

ECONOMIC ASPECTS OF SOLID WASTE DISPOSAL AT SEA,
Massachusetts Inst. of Tech., Cambridge.
J. W. Devanney, III, V. Livanos, and J. Patell.
Sea Grant Project Office, Report No, MITSG 71-2, November 20, 1970. 124 p, 12 fig, 71 ref.

Descriptors: *Waste disposal, *Waste dumps, *Solid wastes, *Landfills, *Incineration, Economics, New York, Costs.
Identifiers: New York City.

A comparison of the market costs of different solid waste disposal alternatives is made. Through present value analysis, unit market disposal costs are derived for sanitary land fill by rail haul, land incineration, dumping of compacted bales at sea and sea incineration. The potential ecological problems of each system are considered. New York City is used as an example to provide a realistic picture of the potential and economic aspects of solid waste disposal at sea. (Ensign-PAI)
W71-05808

5F. Water Treatment and Quality Alteration

EXPERIMENTAL INVESTIGATION OF THE PRODUCTION OF BACTERIA IN WATER AND CONSUMPTION OF BACTERIA BY DAPHNIA, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennikh Vod
V. I. Romanenko
Mikrobiologia, Vol 39, No 4, p 711-715, 1970. 4 tab, 7 ref

Descriptors: *Bacteria, *Daphnia, *Absorption, Biomass, Water purification, Analysis, Radioactivity techniques.
Identifiers: Antibiotics, Penicillin, Aureomycin.

Consumption of bacteria by daphnia in water basins was determined following suppression of bacterial multiplication by an addition of penicillin or aureomycin. Control cultures provided information on the increment of bacteria in the absence of daphnia. The palatability of antibiotic-treated bacteria was verified through introduction of carbon-14 labeled bacteria and measurement of radioactivity of daphnia. The results coincided with formulae of Romanov and Zonov and that of Huck. The method possesses a greater reliability than the filtration analyses. (Wilde-Wisconsin)
W71-05397

SALMONELLOSIS IN CATTLE,
Ministry of Agriculture, Fisheries and Food, Norwich (England). Veterinary Investigation Center.
E. A. Gibson.
Agriculture, Vol 73, 1966, p 213-216.

Descriptors: *Farm wastes, *Cattle, *Salmonella, Pathogenic bacteria, Infection, Bacteria, Carriers, Disinfection, Water treatment.
Identifiers: *Salmonella dublin, *Salmonella tyhimurium, Calves, Illness, England, Clinical signs, Vaccine, Prevention, Outbreaks.

The article describes the diagnosis, treatment, clinical signs, and prevention of salmonella in cattle. Though usually a disease causing calf losses it can affect adult cattle too. Under British conditions two main organisms are responsible. These are S. dublin which is essentially a pathogen of cattle, and S. typhimurium which seems able to infect all species of birds, animals, and man with equal facility. Recommendations are made for the disinfection and prevention of the disease. (White-Iowa State)
W71-05433

DISEASE TRANSMISSION OF WATER-BORNE ORGANISMS OF ANIMAL ORIGIN,
Minnesota Univ., St. Paul. Dept. of Veterinary Microbiology and Public Health.
For primary bibliographic entry see Field 05B.
W71-05441

COLORIMETRIC METHODS FOR BROMINE,
Illinois State Water Survey, Champaign. Chemistry Section.
Frank W. Sollo, Thurston E. Larson, and Florence F. McGurk.
Environmental Science and Technology, Vol 5, No 3, p 240-246, March 1971. 7 p, 9 fig, 7 ref. U.S. Army Medical Research and Development Command. Contract DA-49-193-MD-2909.

Descriptors: *Water treatment, *Disinfection, *Colorimetry, *Water analysis, Chemical analysis, Color, Water chemistry.
Identifiers: *Bromine analysis, *Bromamines.

Reportedly bromamines are far more effective disinfectants than the chloramines and approach free bromine in disinfecting power. Study was undertaken to develop suitable colorimetric methods for determining free bromine and bromamines in water. Numerous reagents were screened on the basis of their reaction with HOCl, HOBr, NH2Cl, and NH2Br. Five reagents (methyl orange, DPD oxalate, phenol red, brom cresol purple, and phenosafranin) were selected for detailed investigation. Free bromine, free chlorine, bromamines, and chloramines may be distinguished from one another. Free bromine alone may be determined by the brom cresol purple or phenosafranin tests. PS is the less sensitive of the two tests. Phenol red is a unique test for total bromine. The DPD and MO tests may be used to determine plus free chlorine. The DPD test serves well to indicate total halogen, if potassium iodide is added to the sample. The MO test is also suitable for the determination of total halogen, in the presence of bromide ion. To form bromamines in a water supply by addition of chlorine and bromide ion, these would have to be added to a small volume of the water at low pH to form free bromine, and subsequently this solution would have to be mixed with the remainder of the water to be treated. (Knapp-USGS)
W71-05576

ACCOMMODATING UNCERTAIN FORECAST IN SELECTING PLANT DESIGN CAPACITY,
Gesellschaft fur Klaranlagen und Wasserversorgung, Mannheim (West Germany).
Paul M. Berthouex.
Journal of the American Water Works Associatio
Vol 63, No 1, p 14-20, January 1971. 7 p, 7 fig, tab, 38 ref.

Descriptors: *Optimization, *Water treatme *Design, *Forecasting, *Water demand, *Safe factors, *Statistical methods, Economics, Decisi making, Growth rates.
Identifiers: *Uncertainty.

The purpose of this paper was to outline metho for quantitatively considering factors which i fluence the design capacity selection for wa treatment plants. The six factors considered wer (1) the useful life of facilities; (2) the ease of e pansion; (3) the rate of growth of the service are (4) the rate of interest on the loan; (5) the chan in purchasing power during the debt period; a (6) the performance of the facilities during t early years. One other factor added was the lear ing curved effect, i.e. technological advances whi tend to offset the curse of inflation. The analy was expanded to show how safety factors, expect to provide an economic hedge against using unce tain forecasts of demand were derived. A bri review of forecast errors and the concept of econ my of scale in construction was given. Linear a exponential demand forecasts were considere The economic objective was simply to minimi long term costs, or to minimize expected long te costs when the forecast was treated as uncertai Simple demand growth situations were consider and two easily implemented optimization metho the Golden Section and the Hooke-Jeeves searc were suggested for finding optimal design capa ties. These two cases were said to give the plann upper and lower bounds on the demand capaci (Kriss-Cornell)
W71-05676

UTILIZATION OF ALKOXYSILANES FO REDUCTION OF THE ABUNDANCE O PHYTOPLANKTON DURING 'BLOOMS' O WATER BASINS (IN RUSSIAN),
Moscow State Univ. (USSR).
N. S. Stroganov, V. G. Khobotiev, L. V. Kolosova and M. A. Kadina.
Doklady Adademii nauk SSSR, Vol 181, No 5, 1257-1259, 1968. 2 fig, 2 tab, 13 ref.

Descriptors: *Herbicides, *Algae, Toxici Scenedesmus, Chlorella, Daphnia, Deteriorati Water treatment, Degradation (Decomposition).
Identifiers: *Algal blooms, *Organo-silicates, *A koxysilanes, Scenedesmus quadricauda, Chlore vulgaris, Daphnia magna, Limnaea stagnal Ouspenskii's medium.

A search for herbicides suppressing algal bloom but harmless to zooplankters and other hydrobion lead to investigation of organo-silicates: veny triethoxysilane, tetraethoxysilane, a trifluoropropenyl- (methyl)-diethoxysilane. T test organism included Scenedesmus quadricaud Chlorella vulgaris, Daphnia magna, and Limna stagnalis. The count of survived specimens showe that the concentration of 0.01 mg/liter of all i vestigated compounds eliminated 93% to 96% algal cells without damaging either daphnia or mo lusks. Among the advantages of the alkoxysilanes their relatively rapid disintegration in wate (Wilde-Wisconsin)
W71-05719

FARM WASTES.
For primary bibliographic entry see Field 05D.
W71-05747

ORIGINS AND NATURE OF FARM WASTE DISCUSSION,
Gowan, Douglas.
For primary bibliographic entry see Field 05B.
W71-05749

M WASTES: PUBLIC HEALTH AND SANCE PROBLEMS OFF THE FARM,
msford Rural District (Essex). Chief Health ector.
C. Bartrop.
ceedings of Symposium: Farm Wastes: The In- e of Water Pollution Control and The Univer- f Newcastle upon Tyne, Paper No 5, p 33-37, . 5 ref.

riptors: *Public health, *Legislation, Farm es, Odors, Diseases, Bacteria.
ifiers: *Public nuisance, Noise, Rats, Flies.

nuisances and public health problems are ntable. To achieve this it is necessary to cou- ood siting and good design with good animal andry. Failure to do this voluntarily must in- bly lead to stricter planning control and the gthening of public health law, for the develop- of intensive farming has outstripped con- ng legislation. Agriculture, as an industry, s certain privileges, but it cannot claim the ege of causing a nuisance or a public health em. (See also W71-05747). (Christenbury-State)
-05752

MUNITY WATER SUPPLY IN DEVELOP- COUNTRIES: A QUARTER-CENTURY OF ED STATES ASSISTANCE,
n Carolina Univ., Chapel Hill. Dept. of En- mental Sciences and Engineering.
rimary bibliographic entry see Field 03B.
-05821

Water Quality Control

ENVIRONMENTAL SURVEY OF THE ER CLEARWATER RIVER,
o Univ., Moscow. Water Resources Research

rimary bibliographic entry see Field 04A.
-05336

AGEMENT OF AGRICULTURAL OURCES TO MINIMIZE POLLUTION OF URAL WATERS,
State Univ., Ames. Dept. of Agricultural En- ring.
.. Willrich.
r 4A1-3 of the National Symposium on Quali- andards for Natural Waters, University of igan, Ann Arbor, July 19-22, 1966. 18 p, 29 WRR Project A-013-IA (1).

riptors: *Water pollution control, *Water gement (Applied), *Agricultural engineering, conservation, Water conservation, Crop uctivity, Irrigation programs, Soil chemistry,

ifiers: Farm water management.

agers of agricultural resources can adopt prac- which will control, sustain or enhance pollu- caused by agricultural operations and certain al phenomena. However, water of inferior ty has existed and will continue to exist. Water tants of major concern which may result from and livestock production include: (1) sedi- , (2) pesticides, (3) inorganic dissolved solids, cularly total salt content and nitrogen and (4) en-demanding materials. Topography modifi- n practices incorporate many of the principles ater-flow control to reduce or eliminate water tion and erosion, including interception of pitation, surface detention, silt deposition, soil ration, slow release of excess water, and adation or attentuation of pollutants within the gically and chemically active soil filter. cultural usage of pesticides can result in spread, low-level surface water pollution gh land runoff. Pesticides applied on or in the re generally fixed by soils or destroyed by soil organisms. Corrective practices to prevent en-demanding materials in feedlot runoff from entering surface waters are available. (Knapp-USGS)
W71-05341

MODEL FOR FLOW AUGMENTATION ANALYSIS - AN OVERVIEW,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
George R. Grantham, Edwin E. Pyatt, James P. Heaney, and Buford J. Carter, Jr.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA5, p 1045-1055, October 1970. 11 p, 5 fig, 12 ref, append. FWQA Research Grant 16090 DRM, (formerly WP 1050).

Descriptors: *Low-flow augmentation, *Optimization, Water resources development, Systems analysis, Mathematical models, Linear programming, Regulation, Cost-benefit analysis, Waste dilution, Conjunctive use, Surface-groundwater relationships, Water pollution control.
Identifiers: Flow-augmentation benefits.

Beginning with the premise that the value of low flow augmentation is measured by sewage treatment cost avoided, a hydrologic flow simulator and a water quality linear programming model were interfaced to develop a procedure for determining a lower bound on the value of augmentation. This generalized approach can be applied by others to their specific water pollution control situations. The net benefit function may be determined with a comprehensive derivation of the flow augmentation cost function. This derivation includes not only direct costs, e.g., reservoir construction, but also imputed costs which reflect the value of water in alternative uses. These imputed costs may be important because of the relatively intensive demands for water which could be expected during low flow conditions. (Knapp-USGS)
W71-05365

AN ANALYSIS OF NEW JERSEY'S WATER POLLUTION CONTROL PROGRAM,
Rutgers-The State Univ., New Brunswick, N.J. Bureau of Government Research.
Philip H. Burch, Jr.
Available from NTIS as PB-197 884, $3.00 in paper copy, $0.95 in microfiche. Final technical report, New Jersey Water Resources Research Institute, New Brunswick, Part I (text), November 1970. 209 p. OWRR Project A-016-N.J. (1).

Descriptors: *State Government, Local Governments, Sewage Districts, Regions, Federal Government, Legal Aspects, Administrative Decisions, Planning, Standards, Monitoring, Regulation, *New Jersey, *Water pollution control, *Water quality control.

Prior to 1967 New Jersey's state water pollution control program was deficient in almost every significant respect. Up to the mid-1960's the state had not formulated any consistent set of water quality criteria to guide responsible authorities in the enforcement of an effective water pollution control program. The state health department's stream surveillance or monitoring program also left a great deal to be desired, for over the years there were not enough samples collected at various key points around the state to constitute a truly reliable indicator of water quality conditions. Furthermore, prior to the mid-1960's the state health department relied on what could best be described as variable effluent standards, specifications theoretically drawn up to meet each particular river valley or stream problem, but which were in fact of questionable validity and efficacy. And finally the actual enforcement record of the water pollution control arm of the state health department can only be characterized, up to the late 1960's, as one of extreme timidity or caution, particularly with reference to industrial waste discharge facilities. Fortunately, for the citizens of this highly urbanized and industralized state, there has been a substantial improvement in New Jersey's water pollution control program in recent years. Thanks largely to a rather drastic reorganization and shake-up of the state's water pollution control program--plus, as a result of pressure exerted by other agencies, the imposition of water quality criteria and effluent standards--New Jersey has now established a much more effective program in all major substantive areas other than water quality monitoring.
W71-05380

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL. 8, SECTION J - THE ECONOMIC AND FISCAL ASPECTS OF A REGIONAL WATER QUALITY MANAGEMENT SYSTEM,
Wisconsin Univ., Madison. Water Resources Center.
Anthony H. J. Dorcey.
Available from NTIS as PB-197 887, $3.00 in paper copy, $0.95 in microfiche. Report OWRR C-1228, 1970. 99 p, 13 fig, 13 tab. OWRR C-1228 (1601) (7).

Descriptors: *Water quality control, *Abatement, *Economics, *Cost sharing, *Wisconsin, Standards, Non-structural alternatives, Economic efficiency, Economics of scale, Value engineering, Cost-benefit analysis, Feasibility studies, Water policy, Project planning, Reservoirs.
Identifiers: *Wisconsin River Basin (Wis).

Criteria of economic efficiency, equity, and effectiveness are operationally defined and postulated as desirable in the design of policy to achieve regional water quality objectives. The Wisconsin River Basin is compared to the Ruhr Region and the Delaware Estuary in order to illustrate the uniqueness of effective and efficient policy design for any basin. The technological alternatives for influencing water quality in the Wisconsin River Basin and the nature of least-cost systems for achieving various quality objectives are described. The implementation of economically efficient systems through alternative policy arrangements are considered. The use of effluent charges as a policy mechanism on the Wisconsin River Basin are examined and it is concluded that they would be ineffective. An alternative policy arrangement which attempts to combine the advantages of regulation and economic incentive is suggested. This system-cost sharing arrangement attempts to effectively implement least-cost systems while meeting postulated criteria of equity concerning the distribution of costs and benefits of impounded water quality. (See also W71-05037 thru W71-05041) (Dorcey-Wisconsin)
W71-05383

MATHEMATICAL MODEL OF RECALCINATION OF LIME SLUDGE WITH FLUIDIZED BED REACTORS,
General American Transportation Corp., Niles, Ill.
For primary bibliographic entry see Field 05D.
W71-05387

PORK PRODUCERS AND POLLUTION: LEGAL ASPECTS,
Missouri Univ., Columbia. Dept. of Agricultural Economics.
Donald P. Levi.
Paper delivered at the Annual Meeting of Missouri Pork Producers Association, January 16, 1970, Columbia, Missouri. Agricultural Economics Paper No. 1970-6. 15 p.

Descriptors: *Legal aspects, *Regulation, Farm wastes, Disposal, Missouri, Maintenance, Waste water treatment, Water pollution control.
Identifiers: *Pollution laws, *Lawsuits, Nuisance law, Liability, Stockmen, Law.

Pollution of water and air by feeding operations is becoming a very real problem. Whether this constitutes a nuisance is a question of fact and depends on the circumstances of each case. The relative interests of the parties involved will determine

whether or not a given operation is closed down. Even if one is legally allowed to continue in business, the assessment of actual or punitive damages may make it unprofitable to do so. There is no one thing which farmers can do to guarantee that they be free from nuisance actions. Site selection, proper maintenance, zoning and licensing may help in some cases. (Christenbury-Iowa State)
W71-05418

ANIMAL WASTES - A NATIONAL PROBLEM,
Cornell Univ., Ithaca. Dept. of Agriculture; and Cornell Univ., Ithaca. Dept. of Civil Engineering.
Raymond C. Loehr.
Proceedings of the American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 95, No SA2. 9 tab, 4 fig, 86 ref.

Descriptors: *Farm wastes, *Anaerobic digestion, *Aerobic treatment, Dehydration, Environment, Cattle, Hogs, Poultry, Sheep, Diets, Odors, Ruminants, Weight, Nitrogen, Phosphorus, Potassium, Waste water treatment, Confinement pens, Digestion, Proteins, Moisture content, Physical properties, Density, Chemical properties, *Water pollution sources, Waste dilution, Slurries, Biochemical oxygen demand, Runoff, Ammonia, Chemical oxygen demand, Oxygen demand, Nitrates, Surface waters, Effluents, Coliforms, Incineration, Aeration, Farm lagoons.
Identifiers: *Animal production, *Population equivalents, Fiber content, Manure production, Nuisance potential, Feedlots, Oxidation ditch, Slatted floors.

A state of the art summary is presented on the control and management of animal wastes. Items discussed include the magnitude of the problem, pollution that has been caused by animal wastes, feasible treatment processes, major problem areas, and areas for future activity. Animal production and their subsequent waste production, properties, and characteristics are discussed first. The pollution and nuisance potential is then pointed out with respect to population equivalents. Waste treatment and disposal processes and systems follow. A summary and conclusion point out problems and what direction should be taken in the future. The paper was 86 references. (White-Iowa State)
W71-05420

DIGITAL SIMULATION MODEL OF INORGANIC WATER QUALITY OF TAHOE-TRUCKEE SYSTEM, NEVADA-CALIFORNIA, PROGRESS REPORT,
Nevada Univ., Reno. Center for Water Resources Research.
John V. A. Sharp, Richard L. Bateman, and Jerome A. Westphal.
University of Nevada, Desert Research Institute, Technical Report Series H-W, Hydrology and Water Resources Publication No 6, April 1, 1970. 21 p, 6 fig. FWPCA Program 16080 DPC.

Descriptors: *Model studies, *Digital computers, *Mathematical models, *Water quality, *Dissolved solids, Testing, Water management (Applied), Rivers, Waste disposal, Reservoirs, Water pollution, Planning, Water analysis, Flow, Flow measurement, Water quality control, Inorganic compounds, Hydrologic data, Stochastic processes, Analytical techniques, Equations, Nevada, California, Watersheds (Basins), Data collections, Input-output analysis, Parametric hydrology, Networks, Sampling, Environmental effects.
Identifiers: *Tahoe-Truckee River System.

This is a progress report on research to develop a digital model to simulate inorganic water quality in a complex system. For purposes of developing the model, the Tahoe-Truckee River System was studied. Regular and special analysis contributing to development and testing of the model are preliminary analyses of geology, geomorphic features, soils, and groundwater, daily stream flow records from many stations; monthly flow records; and reservoir storage and release records. The digital model, now approaching final stages of refinement, contains a hydrologic model providing monthly flows, a set of predictive equations, and a set of equations for simulating regulation. The purpose of the model is to describe and predict variation of water quality in terms of total dissolved solids so that accurate management decisions in areas of water quality control, waste disposal and pollution control can be made. By use of the model at its present state of refinement, the observed amounts of total dissolved solids is reasonably near the simulated amounts, and further development of the model is expected to produce more accurate simulation. Many parts of the model are given as formulae. (Yensen-Arizona)
W71-05469

EXECUTIVE ORDER 11548 (DELEGATED FUNCTIONS OF THE PRESIDENT UNDER THE FEDERAL WATER POLLUTION CONTROL ACT).
For primary bibliographic entry see Field 06E.
W71-05488

DELEGATION OF RESPONSIBILITY TO CARRY OUT CERTAIN PROVISIONS OF FEDERAL WATER POLLUTION CONTROL ACT.
Executive Office of the President, Washington, D. C.
For primary bibliographic entry see Field 06E.
W71-05490

NATIONAL OIL AND HAZARDOUS MATERIALS POLLUTION CONTINGENCY PLAN.
Environmental Quality Council, Washington, D. C.
For primary bibliographic entry see Field 06E.
W71-05491

SEVERN RIVER WATERSHED--SEDIMENT AND WASTE CONTROL.
For primary bibliographic entry see Field 06E.
W71-05493

MUNICIPALITIES--SEWAGE DISPOSAL SYSTEMS--FINANCE, CONSTRUCTION AND OPERATION.
For primary bibliographic entry see Field 06E.
W71-05495

INTERSTATE SANITATION COMMISSION--TRI-STATE COMPACT--WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 06E.
W71-05496

TOWN OF PALM BEACH V CITY OF WEST PALM BEACH (CITY'S POWER TO CONDEMN OTHER CITY'S PROPERTY FOR SEWAGE DISPOSAL PURPOSES).
For primary bibliographic entry see Field 06E.
W71-05498

ATMOSPHERIC GAS EXCHANGE IN THE MARINE ENVIRONMENT,
Newark Coll. of Engineering, N.J. Dept. of Civil Engineering.
Ivan Metzger, and Su LING Cheng.
North Eastern Regional Antipollution Conference, Annual, Proceedings, Kingston, Rhode Island, p 27-30, July 22-25, 1969.

Descriptors: *Atmospheric physics, *Gases, *Organic wastes, *Aeration, *Turbulent flow, Water pollution control.
Identifiers: Atmospheric gas exchange.

One aspect of the determination of the capacity of receiving waters to assimilate organic pollution is aeration. Predicting the exchange of low solubility gases with turbulent fluid has been researched. The exchange of such gases with the marine environment can be represented by equations. In these equations the energy dissipation must be evaluated for systems which have wind-induced turbulence. A procedure for this evaluation is given. (Ensign-PAI)
W71-05502

ION EXCHANGE OF WASTE WATER FROM THE FOODSTUFF INDUSTRY,
Royal Danish School of Pharmacy, Copenhagen. Chemical Lab. A.
For primary bibliographic entry see Field 05D.
W71-05509

OFFSHORE-PETROLEUM AND THE ENVIRONMENT.

The Mines Magazine, 35th Annual Petroleum Issue, November 1970, p 10-17.

Descriptors: *Oil wastes, *Drilling, *Oil industry, *Environment, Marine animals, Costs, Exploration, Water pollution control.
Identifiers: *Santa Barbara spills, Environmental protection.

The reasons why it is so important to the nation's domestic security and growth for oil and gas exploration to continue are clarified. The actions to be taken by the petroleum industry to protect the life and beauty of the seas are presented. The major and minor spills and seepage in the Santa Barbara Channel are outlined and the petroleum industry gives their response to the many news articles on the Santa Barbara spills. (Ensign-PAI)
W71-05513

HARBOR DRIFT DISPOSAL,
Corps of Engineers, Washington, D.C.
Patrick A. DeScenza.
The Military Engineer, Vol 63, No 411, January-February 1971, p 31-33.

Descriptors: *Harbors, *New York, *Navigable waters, *Aquatic drift, *Solid wastes, *Waste disposal, Incineration, Water pollution control.
Identifiers: *Drifting debris, Derelict vessels, Shore structures, Dumping.

Each year 15,000 tons of drift and floating debris is removed from the navigable waters of New York Harbor. For many years, drift was disposed of by burning the debris on special floating barges anchored in upper New York Bay. This open burning process was improved from a pollution viewpoint by the addition of rows of water sprays which suppressed the fly ash and roughly scrubbed the gases of combustion. With the advent of stringent pollution controls and the increased emphasis on cleaner environment, other methods of disposal had to be investigated. Following the investigations, the land-based overfire air-pit-type incinerator was selected as the best method of disposal. The incinerator features and its operations are described. (Ensign-PAI)
W71-05514

THE CANADIAN ARCTIC WATERS POLLUTION PREVENTION ACT: NEW STRESSES ON THE LAW OF THE SEA,
Wisconsin Univ., Madison. School of Law.
For primary bibliographic entry see Field 06E.
W71-05515

RECOVERY OF LARGE MARINE OIL SPILLS BY USE OF A VORTEX ASSISTED AIRLIFT SYSTEM,
Battelle Memorial Inst., Richland, Washington. Pacific Northwest Labs.
P. C. Walkup, J. D. Smith, and E. R. Simonson.
Paper presented at the 43rd Annual Conference Water Pollution Control Federation, Boston, Massachusetts, October 4-9, 1970. 36 p, 18 fig, 17 ref.

criptors: *Oil wastes, *Water pollution control, echanical equipment, *Vortices, Ocean waves, ulsions, Flow rates, Winds, Surface waters, es.
ntifiers: *Airlift system.

Federal Water Quality Administration con- ted studies on an apparatus for recovery of ting oil slicks. The device consists of a pump in- ed vortex and a vacuum suction or Coanda noz- A 1/8 inch thick slick could be recovered at the of 960 gallons per hour. The surface current erated by the vortex increased recovery rates above that of the suction nozzle along. Coanda zle tests showed improved performance in sur- waves. (Ensign-PAI)
1-05526

E USE OF COATED FABRICS IN CONTAIN- NT OF PETROLEUM,
stone Coated Fabrics Co., Los Angeles, Calif.
nard T. Headrick, and Edward E. Headrick.
shore Technology Conference, Second Annual, prints, Vol 1, Houston, Texas, April 22-24, 0, p 227-238, 1970. 13 fig.

criptors: *Oil wastes, *Mechanical control, ter pollution control, Oil, Oily water.
ntifiers: *Coated fabrics, *Tents, *Booms, immers, *Tanks.

ted fabric fuel containment has proven per- ency and sharply reduced fire hazard when pared with conventional metal containers. Use embarkment liner tanks with fabric floating fs are often used for water reservoirs. Coated ic tents have been installed for spill contain- t on the ocean bottom off Santa Barbara effec- ly collecting oil and gas seepage from the bot- and transferring the product to a floating col- or tank. Another tent use is collecting fresh er from under water springs in the ocean. A col- ible oil containment boom for open ocean use a skimmer system to receive oil from the boom is being developed. The boom does not attenu- or deflect wave energy, has little draft and board and contours wave surface contours. All hese materials and their uses are described in ail. (Ensign-PAI)
1-05530

VALOP - ITS ORIGIN, DEVELOPMENTS, ATUS, AND OBJECTIVES,
ernational Tanker Owners Pollution Federation, ., London, England.
hur F. Tripp, Jr.
nker Conference. Fifteenth Annual, Addresses, secon, New Jersey, April 27-29, 1970, p 160- 0, 1970.

scriptors: *Oil wastes, *Ships, *Coasts, Water lution control.
ntifiers: *Tankers, *Liability.

lan by tanker owners concerning oil pollution of stlines resulting from negligent oil discharge m their tankers, with the negligence being sumed unless the owner can establish that the ker was not at fault, is presented. The plan igates the owner to remove the oil and provides reimbursement to a national government for ex- ses incurred in the removal. Liability limits are at $100 per gross registered ton of the tanker in- ved or $10,000,000 whichever is less and finan- l capability is guaranteed as well as enforceabili- of claims through arbitration. Over 70% of the rld tanker tonnage owners are presently mem- s. The plans methods and objectives are alysed. National legislation and international nvention activities are taken into consideration the plan. Flexibility of the plan as a developing ncept in oil pollution control is emphasized. (En- n-PAI)
71-05532

AN APPROACH TO ACQUISITION AND HANDLING OF SERIAL ENVIRONMENTAL DATA,
Westinghouse Ocean Research Lab., San Diego, Calif.
For primary bibliographic entry see Field 07C.
W71-05537

MANAGEMENT INFORMATION TECHNOLOGY FOR WASTE MANAGEMENT AND MULTIMISSION ORIENTED RESEARCH,
Federal Water Quality Administration, Washington, D.C. Office of Research and Development.
G. F. Wirth.
1970 IEEE International Conference on Engineering in the Ocean Environment, Panama City, Florida, September 21-24, 1970, Digest of Technical Papers, p 42-44.

Descriptors: *Wastes, *Water pollution control, *Management, *Technology, Computer programs.
Identifiers: *Management information systems, *Research and development, FWQA research system.

Management information system technology to identify, collect, and present information for pollution control or waste management is studied. Federal Water Quality Administration's Research, Development and Demonstration Program is discussed. The way in which information is brought to decision-making in the selection of results sought, implementation of plans in obtaining the results, and the communication of results to potential users is outlined. (Ensign-PAI)
W71-05541

CONGRESS PASSES WATER QUALITY IMPROVEMENT ACT OF 1970.
For primary bibliographic entry see Field 06E.
W71-05542

U.S. AND UN DEBATE MAN'S USES AND ABUSES OF THE SEA.
For primary bibliographic entry see Field 06E.
W71-05543

RIM OF THE SEA BECOMING CROWDED AND DIRTY.
For primary bibliographic entry see Field 06E.
W71-05544

THE FEDERAL-STATE PARTNERSHIP IN MANAGING THE COASTAL ZONE,
Department of the Interior, Washington, D.C.
S. Fred Singer.
Texas Marine Resources and the Sea Grant Program, Conference Proceedings, College Station, Texas, January 16-17, 1969. Texas A and M University, Sea Grant Program, Sea Grant Publication No 102, p 135-145, October 1969.

Descriptors: *Water quality, *Management, *Federal governments, *State governments, *Estuaries, Water pollution control, Coasts.

All levels of government have a great stake in their estuaries which are immensely valuable and which are constantly endangered by pollution. A long range management scheme should be based on some effective use allocation, with complete knowledge of an estuary's development potential and its vulnerability to destruction. The study of estuaries scientifically, technically, economically and socially and then the construction of an optimum mangement structure for the nation's estuarine zone to serve public and private needs in the best possible way was indicated. (Ensign-PAI)
W71-05546

UNITED KINGDOM STUDIES ON RADIOACTIVE MATERIALS RELEASED IN THE MARINE ENVIRONMENT,
Atomic Energy Research Establishment, Harwell (England).
H. J. Dunster.
Biological Implications Of The Nuclear Age, Symposium, Proceedings, Livermore, California, AEC Lawrence Radiation Laboratory, Bio-Medical Division, Oak Ridge, Tennessee, p 145-155, December 1969. 5 tab, 14 ref.

Descriptors: *Radioactive wastes, *Waste disposal, *Coasts, Water pollution control, *Monitoring, Liquid wastes.
Identifiers: United Kingdom.

The current policy for the disposal of radioactive wastes in the United Kingdom is summarized. The development of discharge criteria, the current basis of control and the results of the monitoring program are discussed. A high standard of safety is achieved by the various government departments so that there is no damage to the marine environment and no limitation on man's use of that environment. Control of the discharges of liquid waste from the fuel-reprocessing plant at Windscale into the Irish Sea is used as an example of their policy in practice. (Ensign-PAI)
W71-05551

RHINE RIVER POLLUTION STUDIES,
For primary bibliographic entry see Field 05B.
W71-05581

BIOASSAY PROCEDURES FOR OIL AND OIL DISPERSANT TOXICITY EVALUATION,
National Marine Water Quality Lab., Kingston, R.I.
For primary bibliographic entry see Field 05C.
W71-05632

STREAM QUALITY MODELING BY QUASILINEARIZATION,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. Stanley Lee, and Irving Hwang.
Journal Water Pollution Control Federation, Vol 43, No 2, p 306-317, February 1971. 12 p, 2 fig, 8 tab, 6 ref.

Descriptors: *Water quality control, *Stream improvement, *Estimating equations, *Mathematical models, Biochemical oxygen demand, Dissolved oxygen, Boundary processes, Data collections, Least squares method.
Identifiers: *Quasilinearization technique, Parameters.

An introduction to a fairly effective technique for estimating parameters or coefficients in differential equations arising in stream quality modeling was proposed. The parameter estimation problem was treated as a two-point or multipoint boundary-value problem by the quasilinearization technique. To illustrate the approach, a simple representation of stream quality proposed by Camp and Dobbins which considered BOD concentration and DO deficit was shown. First, only three data points were available for estimating the rate constants. Then it was desirable to obtain a fairly large amount of data instead of just three data points. A classical least squares criterion was used where parameters were determined so that the sum of the squares of the deviations was minimized. Since the equations used were nonlinear systems with multipoint boundary conditions and could not be solved analytically, the quasilinearization technique, or the generalized Newton-Paphson method, was used and the computational procedure was given in detail. Numerical results included estimation of two parameters, estimation was experimental errors, and estimation of three parameters. A more general estimation problem which used five unknown parameters was also solved by the linearization operation. (Kriss-Cornell)
W71-05679

MODELING AND OPTIMIZATION OF WATER QUALITY IN STREAMS,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.

Rekha S. Rege.
Master's Thesis, Kansas State Univ, 1970. 123 p, 22 fig, 9 tab, 101 ref, 4 append. OWRR Project B-015-KAN (1).

Descriptors: *Optimization, *Mathematical models, *Water quality control, *Cost-benefit analysis, *Stream improvement, Dispersion, Biochemical oxygen demand, Dissolved oxygen, Water treatment, Constrants, Continuity equation.

A steady state on dimensional dispersion model was developed to represent the BOD and DO balances in a stream having several outfalls of waste and intakes of water. The model also included continuous additions and removals of BOD and DO along the stream. In the presentation, a literature survey was made dealing with the development of deterministic models for describing water quality in streams and water quality management models using a deterministic approach. Then a complete description of the formulation of the dispersion model was given. For the purpose of analysis the stream was divided into several segments, each segment beginning at the location of a waste outfall or water intake. The solution was derived by applying continuity equations at the boundary of each segment, and equilibrium conditions at the ends of the stream which were assumed to be infinitely long. The model was extended to incorporate waste treatment plant models at the location of waste outfalls, and water treatment plant models at the intakes. The optimal waste discharge policy along a stream was investigated based on a program of minimizing the total cost benefit function. The feasibility of obtaining a solution by a search technique capable of handling nonlinear constraints on water quality was studied. Application to a hypothetical stream and model use in future research were discussed. (Kriss-Cornell)
W71-05684

INTEGRATION OF CONNECTICUT WATER RIGHTS LAWS AND POLLUTION CONTROL LAWS,
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 06E.
W71-05718

WATER POLLUTION PREVENTION REQUIREMENTS IN RELATION TO FARM-WASTE DISPOSAL,
Thames Conservancy (England). Chief Purification Officer.
H. Fish.
Proceedings of Symposium: Farm Wastes: The Institute of Water Pollution Control and The University of Newcastle upon Tyne, Paper No 6, p 38-43, 1970.

Descriptors: *Farm wastes, *Legal aspects, Biochemical oxygen demand, Water pollution sources, Water quality control, Runoff, River regulation, Riparian waters, Groundwater, Legislation, *Disposal.
Identifiers: *United Kingdom, River authority, Common Law.

This article is concerned with the legal aspects of pollution and how they apply to agriculture. The ways in which farm waste can pollute water supplies and means of limiting the pollution effects are discussed. Large units located in close proximity to urban areas present the most difficult problems. Through cooperation between farmers and the river authority, the pollution effects of farm waste can be held at a minimum. (See also W71-05747). (Christenbury-Iowa State)
W71-05753

SEWERS AND SEWAGE TREATMENT,
Chartered Civil Engineers, London (England); Newcastle upon Tyne Univ (England).
For primary bibliographic entry see Field 05D.
W71-05754

KELLY V KANSAS CITY BLDG AND LOAN ASS'N (LIABILITY TO ADJOINING LANDOWNER FOR OVERFLOW OF SEPTIC TANK).
For primary bibliographic entry see Field 06E.
W71-05772

WATER-QUALITY STUDIES ON THE KALAMAZOO RIVER,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 05B.
W71-05774

BACKGROUND PAPERS ON COASTAL WASTES MANAGEMENT.
National Academy of Sciences-National Research Council, Washington, D.C. Committee of Oceanography; and National Academy of Engineering, Washington, D.C. Committee on Ocean Engineering.
For primary bibliographic entry see Field 05B.
W71-05787

A DIGEST OF ENVIRONMENTAL POLLUTION LEGISLATION IN CANADA, WATER.
Canadian Industries Ltd., New Toronto (Ontario).

Canadian Council of Resource Ministers, May 1970. 362 p.

Descriptors: *Water pollution control, *Environmental sanitation, *Legislation.
Identifiers: *Canada, *Federal legislation, *International Joint Commission, *Province legislation.

The environmental pollution legislation enacted by the eleven senior governments of Canada is presented as a reference for Canadians concerned with judicious management of environmental resources. Federal legislation, the International Joint Commission, and pollution and the common law are included along with acts and agencies of the different provinces of Canada. (Ensign-PAI)
W71-05804

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER. VOLUME I - SUMMARY.
International Lake Erie Water Pollution Board; and International Lake Ontario-Saint Lawrence River Water Pollution Board.

Report to the International Joint Commission on the Pollution of Lake Erie, Lake Ontario and the International Section of the Saint Lawrence River, Volume I, Summary, 1969. 151 p, 4 fig, 11 tab, 5 plate.

Descriptors: *Pollutants, *Physicochemical properties, *Biological properties, Water pollution sources.
Identifiers: Lake Erie, Lake Ontario, St. Lawrence River.

Lake Erie, Lake Ontario and the international section of the Saint Lawrence River are being polluted on both sides of the U.S.- Canadian boundary. Flow studies conducted by agencies in both countries indicate that there is substantial mixing of these waters to have made concentration levels of pollutants uniform throughout each of these bodies of water. Pollution sources, character and disposition of waste inputs, water quality problems, water quality objectives and remedial measures including institutional arrangements and legislation are presented. (See also W71-05806 and W71-05807) (Ensign-PAI)
W71-05805

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE SAINT LAWRENCE RIVER, VOLUME II - LAKE ERIE.
International Lake Erie Water Pollution Boar and International Lake Ontario-Saint Lawren River Water Pollution Board.

Report to the International Joint Commission the Pollution of Lake Erie, Lake Ontario and t International Section of the Saint Lawrence Riv Volume II, Lake Erie, 1969. 151 p, 5 fig, 8 ref.

Descriptors: *Water pollution sources, *Pollutan *Physicochemical properties, *Biological prope ties.
Identifiers: Lake Erie.

A description of the physical features, land a water uses and nearby populations of Lake Erie presented as background to this pollution stud Pollution sources, physico-chemical and biologi characteristics, and developing problems are st died and the effects of these factors are evaluate Water quality objectives are discussed. (See al W71-05805) (Ensign-PAI)
W71-05806

POLLUTION OF LAKE ERIE, LAKE ONTARI AND THE INTERNATIONAL SECTION OF TH SAINT LAWRENCE RIVER. VOLUME III LAKE ONTARIO AND THE INTERNATIONA SECTION OF THE SAINT LAWRENCE RIVER
International Lake Erie Water Pollution Boar and International Lake Ontario-Saint Lawren River Water Pollution Board.

Report to the International Joint Commission the Pollution of Lake Erie, Lake Ontario and t International Section of the Saint Lawrence Riv Volume III - Lake Ontario and the Internation Section of the St. Lawrence River.

Descriptors: *Water pollution sources, *Pollutan *Physicochemical properties, *Biological prope ties.
Identifiers: Lake Ontario, Saint Lawrence River.

A description of the physical features, water us and nearby populations of Lake Ontario and the i ternational sections of the Saint Lawrence River presented as background for a pollution study these areas. Pollution sources, physico-chemic and biological characteristics and the effects material inputs are investigated and objectives f prevention, control and removal are discusse (See also W71-05805) (Ensign-PAI)
W71-05807

INTERNATIONAL LEGAL CONFERENCE O MARINE POLLUTION DAMAGE, FINAL AC OF THE CONFERENCE WITH ATTACHMENT INCLUDING THE TEXTS OF THE ADOPTE CONVENTIONS.
Inter-Governmental Maritime Consultative O ganization, London.

International Legal Conference on Marine Poll tion Damage, 1969, Final Act of the Conferen with Attachments Including the Texts of th Adopted Conventions. 88 p. IMCO No 1970.3.

Descriptors: Water pollution effects, *Oil waste *International law, Conferences, *Water pollutio control, Legislation.
Identifiers: Conciliation, Arbitration, *Civil liabil ty, Insurance, Resolutions.

The final act of the Conference on Marine Poll tion Damage, 1969 is presented. The texts of th adopted conventions are discussed. Included in th is the International Convention Relating to Inte vention on the High Seas in Cases of Oil Pollutio Casualties and the International Convention o Civil Liability for Oil Pollution Damage. Resolu tions are set forth. (Ensign-PAI)
W71-05810

SPILL CONTROL SURVEY FOR SHORE AND OFFSHORE FACILITIES.
erican Petroleum Inst. Committee for Air and ter Conservation.

erican Petroleum Institute, Report No 4023, rch 1970. 382 p, 8 tab, 4 append. A.P.I. Report nber 4023.

criptors: *Oil industry, *Oil wastes, *Water ution control, *Surveys, Oily water, Coasts. tifiers: Prevention, Cleanup.

rvey was conducted in 1969 by a Petroleum in- ry task force to collect information on all oil ities operating in all fifty states bordered by gable waters. The objective of this survey was btain information for planning future programs nprove the capabilities of all oil handling facili- in combating oil spills by prevention, contain- t and cleanup. (Ensign-PAI)
1-05812

CUTIVE ORDER 11523, ESTABLISHING E NATIONAL INDUSTRIAL POLLUTION NTROL COUNCIL.
primary bibliographic entry see Field 06E.
1-05814

NDONED MINE DRAINAGE CONTROL T OF 1970 (LAND RECLAMATION FOR TER POLLUTION CONTROL).
primary bibliographic entry see Field 06E.
1-05819

WATER RESOURCES PLANNING

Techniques of Planning

MPUTER SIMULATION OF PHYTOPLANK- N GROWTH NEAR A MARINE SEWAGE TFALL,
hington Univ., Seattle. Dept. of Oceanography.
primary bibliographic entry see Field 05C.
1-05506

ULATION OF THE HYDROLOGIC CYCLE SMALL AGRICULTURAL WATERSHEDS DIGITAL TECHNIQUES,
inia Polytechnic Inst., Blacksburg. Dept. of cultural Engineering.
. Shanholtz, and J. H. Lillard.
/irginia Polytechnic Institute and State Univer- Water Resources Research Center Bulletin 40, -41, December 1970. 23 p, 16 fig, 5 ref.

criptors: *Model studies, *Mathematical els, *Simulation analysis, Digital computers, ems analysis, Synthetic hydrology. tifiers: *Stanford Watershed Model.

tal simulation models express the physical em of a watershed as a collection of mathemati- expressions. Probably the most comprehensive hese is the Stanford Model. It consists of a p of mathematical expressions which establish tionships between the elements of the rologic cycle and the interactions between its ponents. The model is normally operated with wn input and output and the different model meters are optimized until an acceptable fit is eved. Two agricultural watersheds (Brush k and Crab Creek), having areas of approxi- ely 800 acres and located near Blacksburg, Vir- a, were selected for study because they con- ntly reacted quite differently to given rainfall eriences. Five years of recorded data were used calibrate the model to each watershed after h five additional years of streamflow records e generated using the respective model parame- developed for the first period. For the most , the model appears to simulate the hydrologic process of a watershed within the accuracy of basic input data. The model can provide approximations for the practicing engineer that would be difficult to obtain otherwise. (See also W71-05555) (K-napp-USGS)
W71-05557

WATER RESOURCES PLANNING AND HYDROLOGIC RISK,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
Daniel P. Loucks.
Proceedings of Columbia University Seminar on Pollution and Water Resources, Volume I, 1967-1968, Columbia University, New York, NY, 1971, p 27-39. 13 p, 7 fig, 4 tab.

Descriptors: *Stochastic processes, *Mathematical models, *Optimization, *Water resources development, *Hydrologic aspects, *Risks, Planning, Management, River basins, Linear programming.
Identifiers: Deterministic model.

Some deterministic and stochastic models that were structured for defining and selecting alternative policies for managing (designing and operating) river basin systems were presented. The stochastic models explicitly considered hydrologic risk. Their solutions were compared to solutions obtained from deterministic models to determine the influence of risk on water resources planning. Discrete probabilities were used to approximate the continuous probability distributions of streamflow, reservoir volumes, and other hydrologic events, and discrete intervals of time were used to describe the continuous variable time. The models developed were solely for the preliminary screening of alternatives. They were static models for suggesting what the resource management policies should be, given some estimate of future economic, social and technological conditions. A review of the probability theory that forms the core of many of the stochastic models was given. The problem of determining reservoir capacity, reservoir storage and draft targets, and the reservoir operating policy that maximizes the expected net benefits was used as a numerical example. The deterministic model was presented and then was structured as a stochastic linear programming design model. A third model, called the 'operating policy' model, was developed to complete the multiple-used water resource system. An optimal solution from the two-stage process was obtained. (Kriss-Cornell)
W71-05677

GEOMETRIC PROGRAMMING AND THE PRELIMINARY DESIGN OF INDUSTRIAL WASTE TREATMENT PLANTS,
Rensselear Polytechnic Inst., Troy, N.Y. Dept. of Mathematics; and Union Coll., Schenectady, N.Y. Dept. of Economics.
For primary bibliographic entry see Field 05D.
W71-05680

SENSITIVITY ANALYSIS: A NECESSITY IN WATER PLANNING,
Texas A and M Univ., College Station; Dept. of Industrial Engineering.
W. L. Meier, A. O. Weiss, C. D. Puentes, and Joe C. Moseley.
US Dept of the Interior, 1971. 15 p, 8 fig, 1 tab, 3 ref. Office of Water Resources Research Project B-059-TEX (1).

Descriptors: *Optimization, Simulation analysis, *Computer models, *Water resources development, *Planning, Variability, Cost, Inflow, Reservoir operation, Texas.
Identifiers: *Sensitivity analysis.

Sensitivity analysis was shown to be of significant utility to the planner through presentation of a computer simulation and optimization model which quantified possible variations in system response as a result of uncertainty in the physical and economic conditions of a water resource system. A portion of the Texas Water System was used for the analysis and consisted of 12 reservoirs, 8 river reaches, and 34 pump canals. The system collected excess water in East Texas and transported these waters along with imports from in-state and out-of-state sources to points of high demand in West Texas. A 36-year demand build-up and simulation period was used. A historic filled-in data set and 18 selected synthetic data sets comprised of monthly demand, net evaporation and reservoir inflows were developed using data at all available flow measurement sites and a data filled-in and stochastic data generation procedure. The basic analytical tool used, the SIM III program developed by the Texas Water Development Board and Water Resources Engineers, Inc., was a detailed network simulation/optimization program with a minimum cost objective function on a monthly basis. The model considered evaporation data, import availability, streamflow data, and cost. Reservoir starting contents and size and sequence of canals were used to show response changes in the system. (Kriss-Cornell)
W71-05681

OPTIMIZING THE LONG RANGE OPERATION OF THE CALIFORNIA AQUEDUCT BY INCREMENTAL DYNAMIC PROGRAMMING SIMULATION,
California Univ., Berkeley. Operations Research Center.
I. Haissman, J. L. Matucha, and R. W. Shephard.
Operations Research Center, College of Engineering, University of California, ORC 70-44, December 1970. 41 p, 5 fig, 7 tab. National Science Foundation Grant No GK-23153.

Descriptors: *Optimization, *Dynamic programming, *Simulation analysis, *Computer programs, *Aqueducts, California, Reservoirs, Pumping, Monthly, Constraints.
Identifiers: Water release, Trajectories.

An exploration of the possibility of using incremental methods in dynamic programming to compute pumping and release monthly schedules which minimize the cost of contracted firm power for the operation of the Aqueduct system of the State of California was described. For this purpose the state of the aqueduct at any time was defined by water levels in the five reservoirs of the system. Pumping on the aqueduct and releases of water from the reservoirs result from changes in these five state variables which were traced out by simulation of the system using engineering data on gravity flows in the aqueduct, discharges of pumps and outputs of power at the three generating plants, allowing for deliveries of water to users, and evaporation of water along the way. For each of 120 months, the operation of the system was defined by a five dimensional state variable vector, implying certain releases and pumping of water determined by simulation. A set of 120 such ordered five dimensional vectors defines a trajectory in a state-time space prescribing the operation of the aqueduct over a ten-year period. A computer program was assembled and run to show feasible trajectories which satisfy a variety of constraints for pump capacities, storage of water in reservoirs, generation capacities and surge limitations for the canals. (Kriss-Cornell)
W71-05682

UNBALANCED TENSIONS IN TRANSMISSION LINES,
Pacific Gas and Electric Co., San Francisco, Calif.
For primary bibliographic entry see Field 08C.
W71-05726

SYSTEMS ENGINEERING IN WATER RESOURCES,
Environemtnal Dynamics, Inc., Los Angeles, Calif.
John A. Dracup.
In: Report on 5th Annual Water Resources Research Conference, Sponsored by the Office of Water Resources Research, Dept. of the Interior, Washington, DC, p 171-176, Feb 3-4, 1970. 4 ref.

Descriptors: *Systems analysis, Research and development, Water policy.
Identifiers: *Water resources planning, Comprehensive planning.

Systems engineering is the art and science of selecting from a large number of feasible alternatives that set of actions which will best accomplish the overall objectives of decision-makers. Model building, linear programming, dynamic programming, and simulation are discussed. Current techniques being used by water resources researchers include multilevel optimization using both linear and dynamic programming. Water resource systems engineering has involved application of certain techniques of optimization and operations research to actual or hypothetical systems. Research efforts are moving towards including the stochastic and dynamic aspects of problems in the analysis. Also, research efforts are moving towards tying together several different techniques such as a linear and dynamic programming or mathematical programming and simulation in a multilevel optimazation approach. Needed research seems to be in two areas: (1) taking a single complex water resource configuration and applying several techniques and approaches, and (2) tying together piecemeal approaches in a regional concept. This analysis could then be expanded to include maximizing the benefits from the transportation, education and health inputs to the region. (Wray-Chicago)
W71-05786

6B. Evaluation Process

METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS; REPORT OF EVALUATION OF MINERALS AND MINERAL POTENTIAL OF THE SALMON RIVER DRAINAGE BASIN IN IDAHO SUBPROJECT,
Idaho Univ., Moscow. Water Resources Research Inst.
C. N. Savage.
Available from NTIS as PB-197 885, $3.00 in paper copy, $0.95 in microfiche. University of Idaho Water Resources Research Institute, Scenic Rivers Study Unit, September 1970. 64 p, 8 tab, 15 fig, 28 ref. OWRR Proj B-014-IDA (5).

Descriptors: *Mineralogy, *Mining, *Idaho, *Wild River Act, *Wild rivers, *Evaluation, Mining industry, Metals, Geology, Economic prediction, Water resources, Rivers, Maps, Data collections, Watersheds (Basins), Natural resources.
Identifiers: *Salmon River (Idaho).

Important ores and minerals found in the upper Salmon River drainage basin of central Idaho are listed along with the mining history of each, and amounts of ore and approximate market values where known. A large, important table includes import-export data, consumption, and stockpile information for 29 minerals and ores. Another table evaluates effects of various modern mining methods upon the environment. Fifteen full-page maps of the state of Idaho pinpoint mineral locations and geological formations. A very significant amount of mineral resources lies within the drainage basin under study, and the value of these resources should be considered when drafting regulations governing the use of wild rivers areas. (Yensen-Arizona).
W71-05381

EFFECT OF WATER RESOURCES ON ECONOMIC GROWTH IN THE TENNESSEE VALLEY REGION,
Tennessee Univ., Knoxville. Coll. of Business Administration
For primary bibliographic entry see Field 06D.
W71-05382

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL. 8, SECTION J - THE ECONOMIC AND FISCAL ASPECTS OF A REGIONAL WATER QUALITY MANAGEMENT SYSTEM,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05G.
W71-05383

METHODOLOGICAL ASPECTS OF TECHNICO-ECONOMIC PARAMETERS OF NUCLEAR DESALINATION PLANTS,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
For primary bibliographic entry see Field 03A.
W71-05404

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS,
Idaho Univ., Moscow. Water Resources Research Inst.
E. L. Michalson, and Larry Kirkland.
Idaho University Water Resources Research Institute Progress Report No 1, 1969. 33 p. OWRR Project B-014-IDA (7).

Descriptors: *Scenery, *Recreation, *Wild rivers, *Idaho, Aesthetics, Water use, Conservation, Wild River Act, Streams, Rivers.
Identifiers: *Scenic rivers, Salmon River (Idaho).

The Salmon River, Idaho and its basin has been selected to develop a model system to evaluate wild and scenic rivers. The study involves an inventory of the natural and human resources of the area, estimates of future demands for quantities of these resources, and identification, description, quantification, where possible, of benefits from scenic beauty, personal enrichment, and other esthetic experiences derived from a river. A series of economic models were attempted to evaluate and determine resource use patterns consistent with a Wild and Scenic Rivers System, to compare them with resource use patterns under varying levels of development. A field survey of recreation uses was made in all the major recreational areas of the Salmon River. (Knapp-USGS)
W71-05623

ANNUAL REPORT 1970.
Institute for Water Resources (Army), Alexandria, Va.

Institute for Water Resources, February 1971. 27 p, 4 append.

Descriptors: *Cost-benefit analysis, *Planning, Water resources development, Research and development, Training, Education, *Social aspects, *Cost comparisons, Cost analysis, Cost allocation, *Environmental effects, *Evaluation.
Identifiers: *Public participation.

This is the second Annual Report of the Institute for Water Resources, covering the activities and accomplishments of the calendar year 1970 and projected activities and plans for the future. Section 1 indicates the Organization and Professional Staff of the Institute for Water Resources as of 31 December 1970. Section 2 lists 12 IWR studies which had been published as of 31 December 1970. The 12 research studies completed during 1970 are briefly described. Nine research projects are either under way or planned. Brief discussions are presented on professional development, consultative and problem-solving services, and training liaison.
W71-05663

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, KEOTA, OKLAHOMA.
Garver and Garver, Inc., Little Rock, Ark.
Available from NTIS as PB-191 310, $3.00 i
paper copy, $0.95 in microfiche. Econom
Development Admin, Dept of Commerce, Ma
1970. 45 p.
Identifiers: *Urban planning, *Oklahoma, *Inlan
waterways, Harbors, *Harbors, Site selectio
Economics, Commerce, Industrial plants, Tran
portation, *Arkansas River waterway syste
*Marine terminals, *River basin developmen
*Area planning and development, *Arkans
River, *Keota (Okla), *Haskell County (Okla).

The considerations entering into the findings r
ported include: (1) Analyses of the population ar
economy of the area; (2) a review of recent indu
trial development and current planning for th
acquisition of new industry; (3) local transport
tion facilities as related to potential port sites; (4
an evaluation of sites suitable for port and industr
al development; and (5) estimates of developme
costs. An extensive Appendix, included as a part
this report, contains data of value to organizatio
interested in river port and industrial developmen
including: (1) Criteria for site selection; (2) me
sures for preserving sites suitable for developmen
(3) the use of air and water pollution and physic
blight controls; (4) various methods of financin
including Federal assistance programs; and (5
procedures for attracting industry to port-relate
sites. (See also W71-05665)
W71-05664

**OPPORTUNITIES FOR DEVELOPMENT O
RIVER PORTS ON THE ARKANSAS RIVE
WATERWAY SYSTEM, DARDANELLE-RU
SELLVILLE, ARKANSAS.**
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 314, $3.00 i
paper copy, $0.95 in microfiche. Econom
Development Admin, Dept of Commerce, Ma
1970. 53 p.
Identifiers: *Urban planning, *Arkansas, *Inlan
waterways, Harbors, *Harbors, Site selectio
Economics, Commerce, Industrial plants, Tran
portation, *Arkansas River waterway syste
*Marine terminals, *River basin developmen
*Area planning and development, *Arkans
River, *Dardanelle (Ark), *Russellville (Ark
*Pope County (Ark), *Yell County (Ark), *John
son County (Ark).

The considerations entering into the findings r
ported include: (1) Analyses of the population ar
economy of the area; (2) a review of recent indu
trial development and current planning for th
acquisition of new industry; (3) local transport
tion facilities as related to potential port sites; (4
an evaluation of sites suitable for port and industr
al development; and (5) estimates of developme
costs. An extensive Appendix, included as a part
this report, contains data of value to organizatio
interested in river port and industrial developmen
including: (1) Criteria for site selection; (2) me
sures for preserving sites suitable for developmen
(3) the use of air and water pollution and physic
blight controls; (4) various methods of financin
including Federal assistance programs; and (5
procedures for attracting industry to port-relate
sites. (See also W71-05664)
W71-05665

**A COMPREHENSIVE PLAN STERLING, IL
LINOIS.**
Sterling City Planning Commission, Ill.

Available from NTIS as PB-190 956, $3.00 i
paper copy, $0.95 in microfiche. Wm S Lawrenc
and Associates, Inc. Chicago, Illinois, July 1969
157 p.
Identifiers: *Urban planning, *New York, Terrai
Population, Budgets, Recreation, Classificatio
Drainage, Roads, Transportation, Fire safety, Po
lice, Water supplies, Public health, Sanitary en
gineering, Education, Structural properties, Hou
ing, Costs, Law, *Colden (New York), *Erie Cou
ty (New York), Land use zoning, Land use.

e report contains all the basic studies for a com-
hensive plan for the Town of Colden. The
cific topics covered are land use, physical fea-
es, neighborhood analysis, population, mu-
ipal facilities, educational facilities, circulation
transportation, economic base analysis, and
nicipal finance. For each of the aforementioned
dies a survey was made of existing conditions
/or facilities, where appropriate, projections for
future were made, and their implications for
nning were noted. The basic studies indicate
Colden's popularity as a winter sports area will
tinue. Because of topographic limitations, sub-
an expansion will not be as extensive in Colden
n other areas. However, some suburban expan-
from Buffalo will occur, and the Town through
ing and other land use controls, should insure
future residential developments is compatible
the present character of Colden. This volume
only provides a general frame of reference but
vides specific guidelines for the Comprehensive
ster Plan and for plan implementation.
thor)
1-05670

**ME COMMENTS ON LINEAR DECISION
LES AND CHANCE CONSTRAINTS,**
nell Univ., Ithaca, N.Y. Dept. of Water
ources Engineering.
iel P. Loucks.
ter Resources Research, Vol 6, No 2, p 668-
, April 1970. 4 p, 3 ref. OWRR Project C-1034.

criptors: *Linear programming, *Constraints,
chastic processes, *Evaluation, *Mathemati-
models, *Reservoir operation, Management,
ision making, Storage capacity.
tifiers: Reservoir release.

ecent paper by ReVelle et al. entitled 'The
ar decision rule in reservoir management and
gn, 1, Development of the stochastic model'
69) in which the authors structured some sim-
chance constrained linear programming models
determining the reservoir capacity required to
ntain a range of storage volumes and releases
e specified fraction of the time was discussed.
ir paper was described as among the clearest in-
uctions to the application of probabilistic or
nce constraints and their deterministic
ivalents ever seen. It was said to be one of the
stochastic modeling techniques that could be
nded to a multireservoir problem. A review of
authors' stochastic model was given and then
compared with a linear release rule that in-
ed the current inflow which would result in a
ller required reservoir capacity. In addition,
e was discussion of what the authors called
trol volume K. A paper by Young (1967), cited
stification for using linear rules in their presen-
on, also received comment. (Kriss-Cornell)
1-05675

**PATIAL ALLOCATION MODEL FOR PRO-
TED OUTDOOR RECREATION DEMAND:
ASE STUDY OF THE CENTRAL UPSTATE
V YORK REGION,**
York State Coll. of Agriculture, Ithaca, N.Y.
t. of Agricultural Economics.
primary bibliographic entry see Field 06D.
1-05678

**DELING AND OPTIMIZATION OF WATER
ALITY IN STREAMS,**
sas State Univ., Manhattan. Dept. of Chemical
ineering.
primary bibliographic entry see Field 05G.
-05684

**METHODOLOGY STUDY FOR EVALUA-
N OF WILD AND SCENIC RIVERS,**
o Univ., Moscow. Water Resources Research

halson, E.L., Project Leader. University of
o, Water Resources Research Institute, Scenic Rivers Study Unit, September 1970. 8 p, 1 fig. OWRR Project B-014-IDA (9).

Descriptors: *Wild River Act, *Wild rivers, *Water resources, *Planning, *Evaluation, *Model studies, Water utilization, Economics, Research and development, River regulation, Rivers, Idaho, Natural resources, Water types, Census, State governments, Federal government, Benefits.
Identifiers: *Salmon River (Idaho).

The goal of this study unit is to develop criteria which can be used to determine values of proposed wild rivers and study rivers. Natural and human resources will be developed to try to quantify aesthetic, scenic, and personal benefits derived from the rivers. Alternatives for resource use with economic and social benefits will be studied. The Salmon was selected as the test river for these studies. Categories of rivers such as non-system rivers, wild rivers, scenic rivers, and recreation rivers will be proposed and methods of evaluating and classifying rivers developed. Fourteen subprojects were adopted for study: forest and range resources, minerals, outdoor recreation, commercial fisheries, irrigation, water for municipal and industrial use, water quality control, hydroelectric power, flood control, navigation, transportation and access, anthropology, history and agriculture. Data from these subprojects will be used to develop economic models to aid in evaluating alternative uses of water resources in the river basin area. A list of participating agencies and personnel is given. (See also W71-05703 and W71-05704) (Yensen-Arizona)
W71-05702

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS; REPORT OF FLOOD CONTROL SUBPROJECT,
Idaho University, Moscow. Water Resources Research Inst.
John J. Peebles.
Available from NTIS as PB-197 997, $3.00 in paper copy, $0.95 in microfiche. University of Idaho Water Resources Research Institute, Report, February 1970. 79 p, 12 tab, 33 fig. OWRR Project B-014-IDA (8).

Descriptors: *Flood control, *Idaho, *Wild rivers, *Wild River Act, *Evaluation, Floods, Dams, Water storage, Costs, Benefits, Flood protection, Historic flood, Temperature, Watersheds (Basins), Rivers, Flood damage, Water management (Applied), Surface runoff, Snowmelt, Precipitation (Atmospheric), Maps, Projects, Hydrologic data, Discharge (Water).
Identifiers: *Salmon River (Ida).

This report lists major tributaries to the Salmon River and gives monthly and annual records of temperature, precipitation and discharge of the Salmon at various points. Apparently, no floods have been caused by rain runoff alone, but most are caused by a combination of heavy snow melt and rain runoff. The history of flooding in the Salmon basin is recounted and an appendix of 18 maps illustrates areas probably inundated during the Salmon's worst flood, which occurred in 1894. Costs of past floods are estimated and populations of small communities within the Salmon basin are given. Potential flood control storage sites are discussed, along with costs and benefits. Flood control benefits to the Salmon basin itself would be mostly negligable because of the limited amount of flooding, sparse population and small industrial and agricultural use of the area. However, flood control of the Salmon would benefit the lower Columbia River region. Many graphs and tables document this report. (See also W71-05702) (Yensen-Arizona)
W71-05703

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS; REPORT OF WATER FOR MUNICIPAL AND INDUSTRIAL USE SUBPROJECT,
Idaho University, Moscow. Water Resources Research Inst.
Fred J. Watts.
Available from NTIS as PB-197 998, $3.00 in paper copy, $0.95 in microfiche. University of Idaho Water Resources Research Institute, Report, September 1970. 37 p, 1 fig, 19 tab, 4 ref. OWRR Project B-014-IDA (2).

Descriptors: *Wild River Act, *Wild rivers, *Municipal water, *Irrigation water, *Industrial water, Water resources, Water utilization, Planning, Forecasting, Water demand, Water policy, Water management (Applied), Water consumption (Excludes consumptive use), Water conservation, Rivers, Idaho, Data collections, Withdrawal, Hydrologic data, Watersheds (Basins), Water requirements.
Identifiers: *Salmon River (Ida).

Designation of the Middle Fork of the Salmon River as an instant wild river raised the question of whether or not the river could be maintained in a scenic and free-flowing state without endangering present and future water needs of communities, industries, and agriculture in Idaho. This report determines present water needs for municipal, rural, and industrial use in the state. For this purpose, Idaho is divided into seven regions. Panhandle, Clearwater, Salmon, Southwest Idaho, Upper Snake No. 1, and Upper Snake No. 2. Many tables list water withdrawal needs for these regions. From these data, and illustrated in other tables, projections of industrial and non-industrial water use for future years are made. The author concludes that the Wild Rivers designation for the Middle Fork of the Salmon River will have no effect upon present and future use of water in the Salmon River hydrological area nor upon needs of the entire state. (See also W71-05702) (Yensen-Arizona)
W71-05704

THE EXPANSION OF OUTDOOR RECREATION FACILITIES; TWO CASE STUDIES FINANCED UNDER THE LAND AND WATER CONSERVATION FUND ACT IN WASHINGTON STATE,
Washington Univ., Seattle.
Daniel Perry Beard.
M. A. Thesis, 1969. 94 p, 16 fig, 64 ref, 2 append.
OWRR Project B-019-WASH (4).

Descriptors: *Recreation, *Local government, *Federal government, *Planning, *Water resource development, Economic evaluation, Costs, Time, Prices, Lakes, Land, Water law, Pollution, Financing, Population.
Identifiers: *Land and Water Conservation Fund Act, *Portage Island, *Lake Washington Beach, *Phasing.

This thesis investigates the efforts of federal, state and local governments in attempting to expand the outdoor recreation facilities within Washington State. Two recreation projects undertaken by local agencies and funded under the Land and Water Conservation Fund Act are studied. The City of Renton's Lake Washington Beach project and the Portage Island project undertaken by Whatcom County were the largest acquisition and development projects undertaken by local agencies. The historical background of the project and the actual process used to fund the project are examined with particular attention paid to the problems encountered during implementation. Particular attention is focused on the success of local planning, justification of site selection and the time required to complete applications and receive state and federal funds. On the basis of comparisons between the two projects the author recommends: (1) the time required for awarding of funds must be minimized; (2) phasing must be discontinued; (3) the time an application is valid must be limited; (4) a status report for all applications submitted should be implemented; and (5) a regional clearinghouse should be created to give local governments a source from

which to obtain information concerning all federal assistance programs. (Murphy-Rutgers)
W71-05721

CRITERIA AND METHODS FOR STATE WATER RESOURCE PLANNING,
Wyoming Univ., Laramie. Dept. of Agricultural Economics.
Thomas L. Dobbs, Paananen Orman, and Paul A. Rechard.
Available from NTIS as PB-198 031, $3.00 in paper copy, $0.95 in microfiche. Wyoming Water Resources Research Institute, Water Resources Series No 22, Jan, 1971. 68 p, 3 tab, 71 ref. OWRR Project A-001-Wyo (35).

Descriptors: *Planning, *Cost-Benefit Theory, Indirect benefits, Discount rate, Simulation analysis, Water resources, Development, *Evaluation.

Criteria that might be used for evaluating alternatives in Wyoming water planning programs are discussed in this report. Theoretical aspects of planning criteria are presented and considerable attention is devoted to questions relating to efficiency criteria. Criteria relating to goals other than the efficiency goal are discussed to a limited extent, and conceptual aspects of multiple goal planning are treated briefly. Quantitative methods for analyzing water projects and plans on the basis of various criteria are discussed, with emphasis given to the simulation technique.
W71-05769

SOME PROBLEMS IN ESTABLISHING A NATIONAL WATER POLICY; STATEMENT PROPOSED FOR THE NATIONAL WATER COMMISSION, NOV. 5, 1970,
Washington Univ., St. Louis, Mo.
Charles L. Leven.
Institute for Urban and Regional Studies, Working Paper Ins 8, Washington University, St. Louis, Missouri, December 1970. 27 p, 1 chart.

Descriptors: *Water policy, *Planning, *Decision making, Resource development, Multiple purpose, Optimum development plans, Analytic techniques, *Cost-benefit analysis.
Identifiers: Environmental policy, Comprehensive planning.

In carrying out its water resource development policies, the federal government imposes three kinds of impacts on the nation and its regions: construction, services, and development. The construction impact deals with the impact of using resources to build water resource projects, both the service and development impacts refer to the impact on the economy of project facilities and the services coming from them. In discussing the economic considerations of the long-run development impact of national water policy, there are four specific areas examined. (1) Estimatimation of future 'needs'--present planning techniques are inadequate because of difficulty in establishing a unit value for benefits, setting interest rates, and estimating costs. (2) Benefit estimation for a single region--occassionally local decisions may not be consistent with national criteria or they fail to recognize interregional interaction. (3) Measuring economic benefits to the nation--problems of noncomparability of multiple effects are difficult to overcome. (4) Recommendations for establishing a National Water Policy--policy ought to be concerned with tapping the environment in order to meet preconceived needs of the population, and in restructuring the environment in ways which change the terms on which water and other services as well will be available in the future and how such availability will influence the total economic adjustment process. (Wray-Chicago)
W71-05773

WATER RESOURCES REGIONS AND SUBREGIONS FOR THE NATIONAL ASSESSMENT OF WATER AND RELATED LAND RESOURCES.
Water Resources Council, Washington, D.C.

July 1970. 187 p.

Descriptors: *Management, *Water policy, *Administration, Analytical techniques, *Regions, *Land use, *Land resources, Water utilization.
Identifiers: *National assessment, Subregion delineation.

The Water Resources Planning Act (P.L. 89-80) directs the Water Resources Council to study and assess the adequacy of water supplies necessary to meet the water requirements in each water resource region in the United States, and also to study the relation of regional or river basin plans and programs to the requirements of larger regions of the Nation. This first National Assessment of Water and Related Land Resources was issued in 1968. One of the initial tasks involved in preparing for the next assessment is the delineation of geographic areas suitable for analysis. Guidelines for subregion delineation include: (1) areas drained by a river system; (2) a geographic area with common water management problems; (3) metropolitan regions; and (4) county lines. To facilitate compilations of data each county is identified as to its location within Economic Areas, Land Resource Areas, and Standard Metropolitan Statistical Areas. Every county is listed in its appropriate region and area. Maps outlining each of these geographic areas, as well as the water resource regions, subregions , and subareas are included. (Wray-Chicago)
W71-05775

ACCESS--ITS EFFECT ON AREA GROWTH AND ENVIRONMENTAL QUALITY.
Washington State Water Research Center, Pullman.

Conference held at Central Washington State College, Resource Planning Center, Ellensburg, Washington, May 15, 1970. 76 p. OWRR Project A-999-WASH (3).

Descriptors: Environment, *Environmental effects, *Urbanization, *Planning, Decision-making, *Social aspects, Social change, *Evaluation, *Regions, Ecology, Conservation, Natural resources, Water resources development, *Population.
Identifiers: *Environmental quality.

This was the second conference of the Resource Planning Center on economic growth and environmental quality. The following papers were presented: Growth Pressures and Response to Access Change, by Jerome Pickard; Quality and Human Dimensions of the Environment, by Gordon Hall; Access to Water, by Charles Roe; Access to Private Development, by Jerry Rogers; and Access to National Parks, National Forest, Wild Rivers, and Wilderness Areas, by William Worf. (See also W71-05777 thru W71-05781)
W71-05776

GROWTH PRESSURES AND RESPONSE TO ACCESS CHANGE,
Department of Housing and Urban Development, Washington, D.C.
Jerome Pickard.
In: 'Access- Its Effect on Area Growth and Enivronmental Quality' Central Washington State College, Ellensburg, Washington, May 15, 1970, p 3-17. 2 chart, 3 map. OWRR Project A-999-WASH (3).

Descriptors: *Planning, Decision-making, Social aspects, Social change, Urbanization Population, Optimum development plans.
Identifiers: *Comprehensive planning, Regional development, Metropolitan areas, Environmental quality, Urban environment, Water resources planning.

What we see in the physical, social, and econom development of our society is essentially the res of a sequence of evolution of human societies, fro simple society in which most of the economic a tivity was devoted to subsistence livelihood a then evolved into a mercantile type of society in t Middle Ages. This mercantile society progressed accelerating rate from the middle of the eighteen century into the industrial age which produced entirely new dimension. Urban regions appear with the industrial age. In the twentieth centu the megapolis is developing. The problems society and the environment presented by t growth are now being studied and discussed; the is a danger of having a premature determination what to do about a complicated problem. Planni for the future should coordinate all of the proces that affect planning: water resources, location transportation facilities, and the types of tho facilities and where people live and work. (See a W71-05776) (Wray-Chicago)
W71-05777

QUALITY AND HUMAN DIMENSIONS OF TH ENVIRONMENT,
Hall and Goodhue, Monterey, Calif.
Gordon Hall.
In: 'Access--Its Effect on Area Growth and E vironmental Quality,' Central Washington Sta College, Ellensburg, Washington, May 15, 1970, 20-33. OWRR Project A-999-WASH (3).

Descriptors: *Environment, Planning, Natu resources, Conservation.
Identifiers: *Environmental quality, Environmen problems.

Beautifying America is not a process; America beautiful naturally. Before industrialization, m seems to have lived more in tune with nature. No the public will have to start demanding the pres vation of nature's beauty. For example, highwa have often led to blighting screens which prevent from seeing the countryside. Roads should be bu to emphasize natural beauty in addition to buildi with efficiency--and blight should be prohibite Zoning is one way of limiting blight along highwa but pressure will have to begin from the pub which shows its concern for the preservation of t environment. (See also W71-05776) (Wra Chicago)
W71-05778

ACCESS TO PRIVATE DEVELOPMENT,
Dillingham Land Corp., Los Angeles, Calif.
Jerry Rogers.
In: 'Access--Its Effect on Area Growth and E vironmental Quality,' Central Washington Sta College, Ellensburg, Washington, May 15, 1970, 49-65. OWRR Project A-999-WASH (3).

Descriptors: *Urbanization, *Community develo ment, City planning, Social change, Populatio Planning.
Identifiers: *Urban environment, Metropolit areas, Social system.

In many American cities, the importance of t railroad has diminished and along with it the re estate development that was originally on the routes. Since the 1930's the highway has been predominant factor in access, which in turn fluence real estate development. The la developer is totally dependent on access routes f his activity because land that is not accessible h very little value. Generally, access has been pr vided largely by the public agencies which dicta the standards. The ability to absorb access co into private land development is limited, and t financing methods prohibit long range planning the developer. In larger development (sever thousand acres) the developer has been able to fluence access routes to some extent, but costs volved have not made it profitable. The gover ment and private developers are now becomi concerned about developing more economic hou ing. Because sprawling urban areas have not eas

sing problems, developers are now looking k into high density areas. They are also in- sted in high density buildings in recreation as instead of subdividing mountain land to pro- low-density lots for only a few people. (See W71-05776) (Wray-Chicago)
1-05780

CESS TO NATIONAL PARKS, FORESTS, LD RIVERS, AND WILDERNESS AREAS,
est Service (USDA), Missoula, Mont. Div. of reation and Lands.
iam Worf.
'Access--Its Effect on Area Growth and En- nmental Quality,' Central Washington State ege, Ellensburg, Washington, May 15, 1970, p 75. OWRR Project A-999-WASH (3).

criptors: *Resource allocation, Environment, logy, Natural resources, Conservation, Multi- purpose.
tifiers: *Public policy, Open space, Environ- tal policy, Environmental problems.

federal government has drastically changed its cy in the last 100 years from one of land osal to land acquisition. The National Forest rs about ten percent of the United States, and rding to present land use policy, will not be ur- zed or developed for private residences. Con- ersy in the Forest Service recently has involved questions of access, especially for recreational poses; (2) areas designated as Wilderness which flict with highway planning; and (3) problems the use of off-road motorized vehicles. Com- es with mining rights in Wilderness areas have to work with the Forest Service in developing ss routes. The National Park Service is con- ring the use of pod conveyors as an alternative ne automobile in order to reduce noise and air ution. Multiple use decisions setting long-range agement objectives for National Forest lands have considerable impact on the economies, development, and the population trends on the s around the National Forests. (See also W71- 76) (Wray-Chicago)
-05781

EARCH INTERRELATIONSHIPS OF THE TIONAL WATER COMMISSION, WATER OURCE COUNCIL, AND THE COMMIT- ON WATER RESOURCES RESEARCH,
eral Council for Science and Techology, hington, D.C. Committee on Water Resources earch.
ren A. Hall.
Report on 5th Annual Water Resources earch Conference, Washington, DC, Sponsored ne Office of Water Resources Research, Dept. e Interior, Feb 3-4, 1970, p 7-20. 3 fig.

criptors: *Inter-agency cooperation, *Water cy, Federal government, Decision-making, Fu- planning.
tifiers: Resource policy, Comprehensive ning, Water supply systems.

rrelationships of the National Water Commis- Water Resources Council, and Committee on er Resources Research is discussed. The goals gencies of water resources arise from the con- ents, and those goals are more easily achieved n agencies cooperate. In considering the fu- predictions of a doubling in US population 1965-2000 indicate the water supply systems e unable to match the population growth from ning to actual water service takes 20-25 years, planning is not presently being done for 2000. iously, when the National Water Commission mmended a water supply plan, there were al- ative water supplies to be considered; with in- sed population the alternatives will diminish conflicts will increase. The Federal water pro- will have to conduct problem-orientated arch to meet expanded water service needs. use of limited research funds, there is a need lecting the most important and visible alterna- tives upon which the research is to be established; because of limited time good research on all alternatives is necessary to speed up the 'political hassle.' Crash programs are always more costly, and to eliminate the waste of crash programs, water resource planners must begin working immediately to meet the needs of expanded population. (Wray-Chicago)
W71-05783

A FRAMEWORK FOR URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineering, Cambridge, Mass.
M. B. McPherson.
In: Report on the 5th Annual Water Resources Research Conference, Sponsored by the Office of Water Resources Research, Dept. of the Interior, Washington, DC, Feb 3-4, 1970, p 143-148. 1 fig. 8 ref.

Descriptors: *Water policy, Future planning, Urbanization, Municipal water.
Identifiers: *Metropolitan areas, Water supply systems, Comprehensive, Water resources planning.

The evolution of the United States from an argarian to an urban society has seemingly outpaced the capacity for adjustment of our prevailing institutions of government. The greatest task of local governments in the future will be in providing new services. To meet needs of water services in urban American, government and academic cooperation is urged in research, and centralized direction in operation. Recent studies of research needs on urban water resource have found a preponderance of critical needs at the interfaces, likages and interrelationships with all other urban system elements. Research needs focus on providing the bases for devising new policies, creating new programs and establishing new institutions. The broad objective of all research should be to clarify the interactions that take place through linkages of 5 major areas (cf.figU). The immediate objective of individual research would be reinforcement of knowledge on one of the major categories. In the past, water resource development has been essentially land-orientated; future planning must be people-orientated. Scientists must be consequence-conscious in water resource planning and attempt to make their technological data understandable to citizens who make judgements. (Wray-Chicago)
W71-05784

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMICS OF PERCUSSION VERSUS AIR ROTARY DRILLING,
Mission Mfg. Co., Houston, Tex.
For primary bibliographic entry see Field 08A.
W71-05687

6D. Water Demand

FUTURE WATER DEMANDS - THE IMPACTS OF TECHNOLOGICAL CHANGE, PUBLIC POLICIES, AND CHANGING MARKET CONDITIONS ON THE WATER USE PATTERNS OF SELECTED SECTORS OF THE UNITED STATES ECONOMY: 1970-1990,
Resources for the Future, Inc., Washington, D.C.
Charles W. Howe, Clifford S. Russell, Robert A. Young, and William J. Vaughan.
Available from NTIS as PB-197 877, $3.00 in paper copy, $0.95 in microfiche. Report National Water Commission NWC-EES-71-001, March 1971. NWC-EES-71-001. 114 p.

Descriptors: *Water demand, *Economic prediction, *Municipal water, *Industrial water, *Irrigation water, Technology, Political aspects, Water distribution (Applied), Distribution systems, Water pollution sources, Domestic use, Thermal powerplants, Oil industry, Sugar beets, Arizona, California, Texas.

This report summarizes the findings of 3 studies on water demands: (1) urban, (2) industrial, and (3) agricultural; it analyzes the effects of likely market trends, public policies, and technological change on water use and water pollution. The 3 studies concentrate on representative establishments, but frequently generalize results. (1) The urban study focuses on residential demands, and gives aggregate extrapolations from 1970 to 1990; trends in commercial demands are also discussed. Economically feasible ways to reduce losses from municipal water systems are analyzed thoroughly. (2) Three industries were analyzed in detail: thermal electric power, beet sugar refining, and petroleum refining. In each industry the withdrawal, consumption, and wasteload patterns of a representative plant are studied as functions of water price, water quality standards or effluent charges, input qualities, and output mix; aggregate projections are given. (3) The agricultural study characterizes typical farms in 3 major irrigation areas: the Lower Colorado Basin, Central Arizona, and the hard soils section of the Texas High Plains. The responses of water use patterns to water pricing, farm programs, and technology are traced.
W71-05339

AN OPTIMUM WATER ALLOCATION MODEL BASED ON AN ANALYSIS FOR THE KISSIMMEE RIVER BASIN (PHASE I)-PROGRESS REPORT.
Florida Univ., Gainesville. Dept. of Agricultural Economics; and Central and Southern Florida Flood Control District, West Palm Beach.
For primary bibliographic entry see Field 02E.
W71-05370

EFFECT OF WATER RESOURCES ON ECONOMIC GROWTH IN THE TENNESSEE VALLEY REGION,
Tennessee Univ., Knoxville. Coll. of Business Administration.
Charles B. Garrison.
Available from NTIS as PB-197 886, $3.00 in paper copy, $0.95 in microfiche. Completion Report, January 1971. 49 p, 9 tab, 3 fig, append. OWRR Project A-015-TENN (1).

Descriptors: *Streamflow, Regression analysis, Population density, Spatial distribution, Groundwater, Cost-benefit analysis, Evaluation, Water quality.
Identifiers: Water resources investment, *Economic growth, *Water availability, Chi-square tests, Water-oriented manufacturing, Manufacturing employment, Recurrence interval, Nonparametric statistics.

This study is concerned with the microlocation effect of water availability on manufacturing activity within the 194 county Tennessee Valley Region. The objectives of the study are to determine whether a statistically significant relationship exists between water availability in the region and location of water-oriented manufacturing activity; to determine whether a critical or threshold level of water availability can be identified and to quantify the relationship between water availability and manufacturing activities. Measures of both water availability or streamflow, and water-intensive manufacturing employment are developed at the county and small region level. Streamflow or water availability is measured by the annual seven-day low flow with a recurrence interval of ten years. A positive relationship was found between water availability and employment in water-intensive activities. Chi-square tests of independence indicate concentration of at least 500 employees are related to water availability. The tests indicate also a 7-day, 10-year minimum streamflow of 400 cfs is the threshold level of water availability for employment concentration. Additional locational factors were examined to explain the geographic distribu-

tion of employment concentrations. Regression analysis indicated a positive relation between population density and water-intensive employment. An estimate of the change in water-intensive employment by region was derived for the period 1959-1968. (Siegenthaler-Rutgers)
W71-05382

HYDROLOGICAL PROBLEMS RELATED TO THE USE OF SALINE WATERS,
Council of Scientific and Industrial Research, New Delhi (India).
For primary bibliographic entry see Field 03C.
W71-05465

AUSTRALIAN-AMERICAN INTERBASIN WATER TRANSFER,
Colorado Univ., Boulder. Dept. of Geography.
M. John Loeffler.
Annals, Association of American Geographers, Vol 60, No 3, p 493-516, September 1970. 14 fig, 4 tab, 14 ref.

Descriptors: *Inter-basin transfers, *Water resources development, *Hydroelectric power, *Arid lands, *Irrigation, Water users, Water utilization, Water policy (Allocation), Legal aspects, Social aspects, Economic feasibility, Political aspects, Federal government, Recreation demand, Human population, Water transfer, Water conservation, Colorado, Regional analysis, Colorado River.
Identifiers: *Australia.

The Australian interior and the American west are both arid, water-starved areas. The concept of interbasin water transfer is not new to either country, but the entry of federal government into water diversion is new to both. The Snowy Mountains Project of Australia, transferring water from the snowy to the Murray River and the Colorado-Big Thompson Project of the U.S., transferring water from the Colorado to the Big-Thompson River, are the first federally-built projects on either continent. As such, they are precedent-setting. There were arguments against both. Most of the Australian population lives near the ocean, giving rise to doubt about the wisdom of diverting water into the arid interior. The Colorado River, in turn, drains the most arid region of the U.S., and can little afford water loss through interbasin transfer. The 2 major reasons for the water diversions, hydroelectric power and irrigation, are thoroughly examined for both regions in terms of economic feasibility. Both factors are clouded by considerations not accounted for in the planning stages. There is some question of the importance of hydroelectric power production in the U.S. in terms of it's percentage of total power production. Also, the importance of irrigation projects for increasing farm production in an already saturated market is questionable. However, there are many benefits, such as increased recreational facilities. Both the merits and the obsolescence of these projects are discussed in detail. (Casey-Arizona)
W71-05477

ACCOMMODATING UNCERTAIN FORECASTS IN SELECTING PLANT DESIGN CAPACITY,
Gesellschaft fur Klaranlagen und Wasserversorgung, Mannheim (West Germany).
For primary bibliographic entry see Field 05F.
W71-05676

A SPATIAL ALLOCATION MODEL FOR PROJECTED OUTDOOR RECREATION DEMAND: A CASE STUDY OF THE CENTRAL UPSTATE NEW YORK REGION,
New York State Coll. of Agriculture, Ithaca, N.Y. Dept. of Agricultural Economics.
Mahfouz E. Tadros, and Robert J. Kalter
SEARCH-Agriculture, Vol 1, No 5, Cornell University Agricultural Experiment Station, New York State College of Agriculture, Cornell University, Ithaca, New York, January 1971. 24 p, 30 tab, 2 maps, 21 ref

Descriptors: *Linear programming, *Spatial distribution, *Optimization, *Computer programs, *Recreation demand, Time, Cost, Distance, Population, Swimming, Boating, Fishing, Camping, New York.
Identifiers: *Allocation model.

An allocation model designed to spatially distribute projected market demand for specified outdoor recreation activities was presented. After reviewing literature on various approaches to the spatial allocation problem such as regression equations, gravity models, and linear systems analysis, a linear programming model that simultaneously handles projected demand by occasion type, capacities of potentially visited recreation zones, and time, distance, and cost considerations was formulated. For the basic spatial allocation model, constraints were specified together with two objective functions; one to minimize total travel time, distance traveled, or cost involve by all visitors from all population zones and the other to maximize the number of visitors traveling to more attractive sites. The model was empirically evaluated via an application to 22 counties in central upstate New York, divided into 83 origin or population zones and 230 destination zones. The region was assumed to be closed area and the model was solved through use of the Fortran IV computer program, for four recreational activities: swimming, boating, fishing, and camping. Projected 1985 market demand was used as demand input for model solution. The solution appeared to give a general feeling for the magnitudes involved in recreational demand distribution. (Kriss-Cornell)
W71-05678

A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS; REPORT OF WATER FOR MUNICIPAL AND INDUSTRIAL USE SUBPROJECT,
Idaho University, Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-05704

SELECTION OF THE OPTIMUM METHOD FOR ESTIMATING THE DEMAND FOR NON-MARKET WATER RESOURCES WITH INCOMPLETE INFORMATION,
Washington Univ., Seattle.
Gardner Brown, Jr.
University of Washington, Seattle, Washington, August 18, 1968. 6 p. OWRR Project A-015-WASH (1).

Descriptors: *Washington, *Sport fishing, *Estimating equations, *Economics, *Elasticity of demand, Salmon, Demand, Recreation, Fisheries, Anadromous fish, Model studies.
Identifiers: *Non-market water resources.

The Washington state sport salmon fishery was used as the working data source in this study, since it represents a valuable non-market water resource with incomplete information available for programming. An analysis of the economic demand for this fishery was undertaken, and an estimated demand equation was formulated, from which is can be suggested that, successfully managed, the non-commercial salmon fishery will continue to grow rapidly. Compared with a similar Oregon study, the income elasticity of demand was much higher, probably because of its basis upon time-series data rather than cross-section data. The model provides qualitative prediction value where quantitative data is not available. (Yensen-Arizona)
W71-05706

SIMULATION VIA TIME-PARTITIONED LINEAR PROGRAMMING: A GROUND AND SURFACE WATER ALLOCATION MODEL FOR THE GALLATIN VALLEY OF MONTANA,
Montana State Univ., Bozeman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 02A.
W71-05716

6E. Water Law and Institutions

ALLEN V WOOD (TITLE TO ACCRETIONS T SEASHORE).

256 Mass 343, 152 NE 617-621 (1926).

Descriptors: *Massachusetts, *Accretion (Le aspects), *Boundaries (Property), *Seashor Shores, Boundary disputes, Riparian land, Ripari waters, Land tenure, Roads, Beaches, Coa Legal aspects, Judicial decisions, Bays, Naviga waters, Oceans.

Plaintiff landowner sought to register title to acc tions to his beachfront property. Plaintiff's prop ty was bounded on the front by the high wa mark, on the back by a public street, and at one e by the intersection of the high water mark and street. Plaintiff contended that, due to accreti his land extended to the intersection of accreted land and a line extending beyond the e of the public street. Defendant landowners c tended that plaintiff owned only up to the inters tion of the street and the high water mark as it isted at the time of the conveyance. The Supre Judicial Court of Massachusetts noted that acc tions to the shore ordinarily belong to the upla owner and that the monument made by described intersection could move as the h water mark moved. However, the court held t plaintiff could not own beyond the end of the str since there was no intersection of high water m and street beyond that point and affirmed judgment partitioning the remainder of the n shoreline among the upland owners. (Lipt Florida)
W71-05367

IN RE WATER FRONT, CITY OF NEW YO (VALUATION OF CONDEMNED WATE FRONT PROPERTY).
246 NY 1, 157 NE 911-922 (1927).

Descriptors: *New York, *Condemnation, *C demnation value, *Land tenure, Judicial decisio Legal aspects, State governments, Local gove ments, Legislation, Contracts, Coastal structu Landfills, Shores, Islands, Navigation, Harbo Bays, Navigable waters, Eminent domain, Real p perty, Docks.

Plaintiff city condemned waterfront property of fendant landowners along the eastern shore Staten Island. Plaintiff and defendants both pealed the awards set in lower courts. Plain claimed that the defendants did not hold fee tit but merely the right to erect and use docks un the original land grant from the state. The Cour Appeals of New York held fee title was the pro basis for assessing value. The land was gran under statutes allowing land commissioners to p vide such title to lands under navigable waters the grantees did not perform conditions subsequ as to constructing docks, it was up to the state, the city, to object. Defendants objected to a lo appellate couion of the awards to the amount t original predecessors-in-title paid for the land, p costs of improvements. The court of appeals firmed the reduction, however, noting that grants under which their predecessor purcha stated that the city could acquire the property the original cost plus the cost of improvemen The clause ran with the title. (Morris-Florida)
W71-05372

AN ANALYSIS OF NEW JERSEY'S WAT POLLUTION CONTROL PROGRAM,
Rutgers-The State Univ., New Brunswick, N.J. reau of Government Research.
For primary bibliographic entry see Field 05G.
W71-05380

ROBINSON V FRED B HIGGINS CO (CO STRUCTION OF PIER REQUIRES PERM

N OF UPLAND OWNER).

A 901-903 (Me 1927).

riptors: *Maine, *Riparian rights, *Piers, *Acroutes, Shores, Riparian land, Riparian waters, s, Oceans, Docks, Coastal structures, Navigation Boats, Ships, Right-of-way, Relative rights, its, Legislation, Usufructuary right, Struc-, Legal aspects, Judicial decisions.

tiff riparian owner sought to enjoin defendant er company from extending its wharf from its ning riparian land in front of plaintiff's land. tiff contended that the wharf would cut off his an right of access to the ocean and that con- o such construction by the upland owner was red by statue. Defendant contended that it acquired all the necessary licenses for the and that plaintiff's denial of permission was sonable in light of the minimal obstruction of ccess and the unsuitability of locating the in front of defendant's upland. Affirming a e in plaintiff's favor, the Supreme Judicial of Maine held that the statutes authorizing es for wharves did not diminish the upland r's right to refuse permission. The court noted he evidence supported a finding that plain- access would be seriously restricted by the sed wharf. (Liptak-Florida)
05391

LD V DIXON (BOUNDARY OF RIPARIAN WHERE SHORELINE DIFFERS FROM AL DESCRIPTION).

489-490 (Ct App Md 1929).

iptors: *Maryland, *Shores, *Boundaries erty), *Riparian land, Bays, Accretion (Legal ts), Boundary disputes, Land tenure, Real rty, Surveys, Mapping, Legal aspects, Judicial ons, Easements.

iff landowner brought action of ejectment t defendant landowner to recover that por- f a bayshore separating defendant's described ary and the actual shoreline. Plaintiff con- l that defendant's tract was bounded by the and bounds in his deed from their common r and claimed title to the land between de- nt's described boundaries and the shoreline. dant argued that his deed conveyed all ges in the bayshore and that the bayshore iginally within the described boundary lines. ing a judgment for defendant, the Court of ls of Maryland noted that the evidence d that the shoreline was originally at least uous with, if not wholly within, the described ary line. The court also noted that, even if the shore was outside of the described line, ference to the shore in the defendant's deed be considered as a call to the bayshore, would take precedence over the description es and bounds. (Hart-Floirda)
05393

V MAYOR AND COUNCIL OF UGH OF EDGEWATER (MUNICIPAL JUCTION TO REQUIRE LICENSE TO E VESSELS ON NAVIGABLE RIVER).
866-874 (NJ 1935).

ptors: *New Jersey, *Cities, *Jurisdiction, lation, High water mark, Low water mark, an land, Riparian rights, Hudson River, ble rivers, Non-navigable waters, Boundary es, Boundaries (Property), Reservation doc- Docks, Piers, Accretion (Legal aspects), spects, Judicial decisions.

f riparian landowner brought certiorari defendant city to review defendant's ability ecute under an ordinance requiring a license e vessels in the Hudson River. Plaintiff con- that defendant's jurisdiction did not extend ls lying between high and low water mark. The Supreme Court of New Jersey noted that: (1) the boundary of a riparian owner on a non-navigable stream extends to the thread of the stream, but the boundary of a riparian owner on navigable waters extends only to high water mark; (2) lands below high water mark belong to the state; (3) the state's title is proprietary; (4) the state's dominion over navigable waters is subject to the Congressional power to regulate navigation; (5) under common law, a riparian owner could appropriate lands between high and low water mark for his own use; and (6) a riparian owner has the right of access to the shore. Determining that municipal jurisdiction extended to low water mark by virtue of defendant's appropriation of property below high water mark for its exclusive use, the court held that plaintiff was subject to prosecution for violation of the ordinance. (Hart-Florida)
W71-05395

FAULKS V BOROUGH OF ALLENHURST (INSTALLATION OF SEWAGE TREATMENT PLANT ON PUBLIC ROAD EASEMENT).
180 A 877-880 (NJ Ct Err and App 1935).

Descriptors: *New Jersey, *Sewage treatment, *Easements, *Roads, Cities, Chlorination, Septic tanks, Sewage disposal, Sewers, Condemnation, Eminent domain, Right-of-way, Compensation, Public health, Riparian land, Oceans, High water mark, Low water mark, Tides, Legal aspects, Judicial decisions.

Plaintiff riparian landowner brought ejectment against defendant city to force removal of a sewage tank and chlorination unit from her premises. Defendant had a public road easement along the edge of plaintiff's tract. At the end of the road, where it ran into the ocean, defendant built a sewage chamber and a chlorination house. Plaintiff contended that these structures surcharged defendant's easement. Defendant contended that the structures were between high and low water mark on accreted land which was state-owned and hence plaintiff had no interest in the site. The New Jersey Court of Errors and Appeals defined 'high water mark' as the line of medium high tide between the spring and neap tides. Reviewing the evidence, the court determined that the high water mark was between the structures and the ocean and held that they were hence situated on the public easement. Since defendant did not attempt to justify the installation as a lawful street use, the court held for plaintiff, noting that defendant might acquire the premises by condemnation and payment. (Hart-Florida)
W71-05403

PORK PRODUCERS AND POLLUTION: LEGAL ASPECTS,
Missouri Univ., Columbia. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.
W71-05418

IN RE LANDS ON UPPER NEW YORK BAY (TITLE TO SUBMERGED LANDS GRANTED CITY BY CHARTER).

215 App Div 204, 213 NYS 486-500 (Sup Ct 1926).

Descriptors: *New York, *Land tenure, *Beds under water, *Cities, Ownership of beds, Beds, Real property, Roads, State governments, High water mark, Bays, Navigable waters, Legal aspects, Judicial decisions, Local governments, Highways.

Plaintiff municipality sought to acquire title to submerged lands in front of its streets. Defendant transit company claimed title to the lands through a conveyance from the state. Plaintiff claimed the lands by virtue of its charter provision passing title in fee to all submerged lands to plaintiff. Defendant's patent was ordered prior to the charter's effect, but was not issued until after plaintiff's charter was effective. Defendant contended that the charter could not pass title to land which the state did not own. The Supreme Court of New York stated that where a highway terminates at high water mark of navigable waters, submerged lands adjacent to the street are subject to an easement essential to the highway. But determining that another charter provision precluded plaintiff from impairing defendant's right to receive its patent, the court held title in defendant. Since the street intersected the shore, defendant's land was subjected to a public easement. The court furthermore noted that plaintiff's title was unaffected by a subsequent street closing, but was determined at the charter's effective data. (Hart-Florida)
W71-05460

CRABBE V MIDDLETOWN HYDRAULIC CO (PRESCRIPTIVE RIGHT TO USE APPROPRIATED WATER).
116 Ohio St 26, 155 NE 554-555 (1927).

Descriptors: *Ohio, *Prior appropriation, *Prescriptive rights, *Bayous, State government, Navigation, Appropriation, Preference (Water rights), Beneficial use, Surplus water, Judicial decisions, Legal aspects, Water rights, Contracts.

Plaintiff state brought quo warranto against defendant hydraulic company. Defendant's predecessors had appropriated bayou water for use as a millrace. Defendant's predecessor conveyed to plaintiff the right to a joint use with him of the water thus appropriated. Under the conveyance, plaintiff received the right to take all water required for navigation, without damage to the reservations in the conveyance. The state never used more than 8000 cubic feet per minute while defendant used between 18,000 and 22,000 cubic feet per minute. Plaintiff sought to compel defendant to reduce its use. The Supreme Court of Ohio held that by use of an amount in excess of plaintiff's use for some 50 years, defendant had acquired a prescriptive right, as against plaintiff, to continue to use the same amount of water. (Hart-Florida)
W71-05472

THE RIO LAUCA: DISPUTE OVER AN INTERNATIONAL RIVER,
Southern Connecticut State Coll. New Haven. Dept. of Geography.
Martin Ira Glassner.
Geographical Review, Vol 60, No 2, p 192-207, April 1970. 2 fig, 18 ref.

Descriptors: *Interstate rivers, *International law, *Water law, *International waters, *Water resources development, Arid lands, River basins, International commissions, Riparian rights, Political aspects, Social impact, History.
Identifiers: *Chile, *Bolivia, *Atacama Desert, *OAS, *Declaration of Montevideo.

The Atacama Desert of northern Chile is one of the driest regions of the earth. The Rio Lauca arises east of the Atacama on the high, semiarid Altiplano, runs 75 km. through Chile and 150 km. through Bolicia, following a shallow gradient, and empties into the Lago de Coipasa, in Bolivia. In 1939, Chile announced plans to divert part of the waters and irrigate the Azapa Valley, in order to provide a stable food supply for the city of Arica. This led to a series of intermittent and increasingly bitter exchanges between the 2 countries, through 1964. In efforts to resolve the problem, 2 different joint commissions investigated the project and an appeal was made to the OAS in 1962. Bolivia views the scheme as a serious transgression of it's rights as a lower riparian state and as another incident in a long history of economic, political and military aggression by Chile. In further claims that the project, by tampering with her 'patrimony', will adversely affect the climate of the Lauca Basin and increase salinization of the Lago de Coipasa. The country has also tied the issue to its long quest for an outlet to the sea (salida al mar). Chile simply views the scheme as an internal development pro-

gram vital to her arid region and is willing to compensate the few Bolivians who will suffer, in order to improve food supplies for 100,000 people. Bolivia has been able to produce no evidence for the claimed damage. Diversion began in 1962. Both countries accept the Declaration of Montevideo, but differ in their interpretation of it's applicability. The author feels that this problem may be solved by regional cooperation, but a great difficulty in cases of this sort, is the lack of a coherent body of international law. (Casey-Arizona)
W71-05485

FLORIDA WATER-RIGHTS LAW,
J. C. Adkins, Jr.
In: Florida Real Estate Law and Procedure, Harrison Company, Atlanta, p 1629-1653, 1960. 25 p, 64 ref.

Descriptors: *Florida, *Water law, *Riparian rights, *Water rights, Legislation, Lakes, Ponds, Natural flow doctrine, Alteration of flow, Civil law, Competing uses, Domestic water, Natural use, Reasonable use, Relative rights, Stock water, Surface waters, Conjunctive use, Drainage, Repulsion (Legal aspects), Riddance (Legal aspects), Surface runoff, Judicial decisions, Non-navigable waters, Subsurface waters.

In this chapter from a treatise on Florida real estate law, the law of water rights in Florida is divided into six sections: (1) Florida water resources law; (2) reasonable use theory; (3) non-navigable lakes; (4) surface waters and watercourses; (5) subsurface or percolating waters; and (6) lakes and ponds. Both case law and legislation relating to water rights is examined. It is stated that the rights of riparian proprietors to use waters of a non-navigable lake in Florida are equal. However, this principle is qualified by a statement that any use must be lawful and not detrimental to rights of other riparian owners. In addition, it is noted that non-navigable lakes may be privately owned. Surface water is described as water derived from precipitation, or rising to the surface from springs. The two rules governing use of surface--the civil and common law rules--are examined. In the discussion of subsurface waters, the author observes that Florida has rejected the common law rule of unrestricted right to draw percolating water from private land. Law pertaining to lakes and ponds is briefly discussed. (See also W71-05487) (Hart-Florida)
W71-05486

FISH (OWNERSHIP; PRIVATE AND PUBLIC RIGHTS),
J. C. Adkins, Jr.
In: Florida Real Estate Law and Procedure, Harrison Company, Atlanta, p 1656-1658, 1960. 3 p, 6 ref.

Descriptors: *Fish, *Florida, *Reservation doctrine, *Public rights, State governments, Legal aspects, Water law, Riparian land, Land tenure, Real property, Access routes, Fishing, Navigation, Civil law.
Identifiers: *Trust doctrine.

This section from a treatise on Florida real estate law, after noting that under Spanish civil law fish were held in trust for the public, observes that the trust principle carried over when Florida was ceded to the United States. This trust doctrine is subject to the federal power over navigation and interstate commerce. It is also noted that the public's ownership of fish is subject to state regulation for the general welfare. Fish are legally classified as ferae naturae, hence their ownership is in the state, not as a proprietor, but in a sovereign capacity as trustee for the people. However, once fish are reduced to possession, they may be properly claimed by particular individuals. Although there is a right to fish in public waters, there is no right to approach public water through private property, or to fish from private property without the owner's consent. (Hart-Florida)
W71-05487

EXECUTIVE ORDER 11548 (DELEGATED FUNCTIONS OF THE PRESIDENT UNDER THE FEDERAL WATER POLLUTION CONTROL ACT).

Federal Register, Vol 35, p 11677-11679, July 1970. 3 p.

Descriptors: *Pollution abatement, *Administrative agencies, *Water pollution control, *Supervisory control (Power), Federal government, Administration, Regulations, Administrative decisions, Jurisdiction, Coordination, Decision making, Leadership, Pollutant identification, Water pollution sources, Ships, Water pollution treatment, Oil, Oily water, Oil wastes, Navigation, Navigable waters, Inter-agency cooperation, Coast Guard regulations, Legal aspects, Institutional constraints.
Identifiers: *Water Pollution Control Act, *Water Quality Improvement Act.

By virtue of the authority vested in him by the Federal Water Pollution Control Act, the President of the United States, in this executive order, delegates authority to various executive departments and agencies. The Secretary of the Interior is authorized to : (1) investigate the control of pesticide release; (2) determine, in consultation with the Secretary of Transportation, the quantities of oil discharge harmful to the public health; (3) identify dispersants and chemicals; (4) determine substantial threats from, the abatement remedies for, oil discharges; (5) carry out provisions preventing oil discharge from non-transportation-related onshore and offshore facilities; and (6) designate hazardous substances, other than oil, presenting dangers to the public health or welfare when discharged onto navigable waters or adjoining shorelines. The Secretary of Transportation is delegated authority to inspect oil-carrying vessels and under proper circumstances, to board such vessels and execute arrest and other warrants. Responsibility for the issuance of regulations governing financial responsibility for oil carrying vessels is vested in the Federal Maritime Commission. Authority for the preparation and publication of oil removal contingency plans is given to the Council on Environmental Quality. The Coast Guard is designated as the agency empowered to receive notices of oil discharge. (Earl-Florida)
W71-05488

NOTICE OF PUBLIC HEARING ON AMENDMENTS TO COMPREHENSIVE PLAN.
Delaware River Basin Commission, Trenton, N. J.

Federal Register, Vol 35, p 11429, July 1970. 1 p.

Descriptors: *Water resources development, *Interstate commissions, *Delaware River Basin Commission, *River basins, Decision making, Public rights, Watershed management, Wells, Sewage treatment, Adoption of practices, Project planning, Atlantic Coastal plain, Northeast U.S., Regions, Administration, Interstate rivers, Institutional constraints, Political aspects, Political constraints, Water allocation (Policy), Water supply, Water policy.

In this notice of public hearings to amend the Delaware River Basin Commission's Comprehensive Plan, seven additional water resource projects are proposed. Replacement wells, filtration facilities, projects to increase permissible levels of well withdrawl, new well-water supply systems, and sewage treatment plants are included within the proposals. (Earl-Florida)
W71-05489

DELEGATION OF RESPONSIBILITY TO CARRY OUT CERTAIN PROVISIONS OF FEDERAL WATER POLLUTION CONTROL ACT.
Executive Office of the President, Washington, D. C.

Federal Register, Vol 35, p 8631, June 1970. 1 p.

Descriptors: *Jurisdiction, *Administrative ag
cies, *Ships, *Supervisory control (Pow
Federal government, Administrative decisions,
ministration, Leadership, Decision making, W
pollution control, Water pollution sources,
Navigable waters, Regulations, Coordinat
Legislation, Cost repayment, Compensation.
Identifiers: *Federal Water Pollution Control A

In this Presidential letter to the chairman of
Federal Maritime Commission, the Commissio
vested with responsibility for implementing th
provisions of the Federal Water Pollution Cor
Act relating to the financial responsibility of
carrying vessels. (Earl-Florida)
W71-05490

**NATIONAL OIL AND HAZARDOUS MATE
ALS POLLUTION CONTINGENCY PLAN.**
Environmental Quality Council, Washington, D

Federal Register, Vol 35, p 8508-8514, June 1
7 p.

Descriptors: *Federal government, *Water po
tion control, *Integrated control measures, *
Administration, Adoption of practices, Oil wa
Multiple-purpose projects, Programs, Coord
tion, Administrative agencies, Long-term plann
Future planning (Projected), Planning, Regulat
Jurisdiction, Inter-agency cooperation, Ins
tional constraints, United States, Pollution ab
ment, Oil water, Water pollution, Warning syste
Non-structural alternatives, Decision making.
Identifiers: *Water Quality Improvement Ac
1970.

Set forth in this contingency plan is a mecha
for coordinating the response to spills of oi
other hazardous material. Effective June 1970
National Multiagency Oil and Hazardous Mate
Contingency Plan is superseded by this promu
tion, developed by the Council on Environme
Quality pursuant to the Water Quality Impr
ment Act of 1970. The Plan consists of six secti
The background, purpose, objectives, and scop
the Plan are presented in section one. Federal
icy and federal and non-federal responsibilities
set forth in section two. The planning and resp
elements, detailed in section three, consist of
(1) National Interagency Committee, (2) Nati
Response Center, (3) National Response Te
(4) Regional Response Center, (5) Regi
Response Team, and (6) on-scene coordina
Federal response operations, response phases,
water-pollution-control procedures are set for
section four. Coordinating instructions, conta
in section five, deal with such areas as : (1) del
tion of authority, (2) multiregional actions,
notification, and (4) patterns of response act
The amendment authority of federal agencies i
forth in section six. Thirteen annexes, dealing
technical aspects of the plan, are also inclu
(Earl-Florida)
W71-05491

**SHORE EROSION CONTROL (EROSION C
TROL DISTRICTS AND CONSTRUCT
LOANS).**

Md Code Ann art 66C, secs 756 thru 758C (S
1970).

Descriptors: *Maryland, *Erosion control, *S
protection, *Loans, Legislation, Control st
tures, Bank protection, Erosion, Bank ero
Beach erosion, Sedimentation, Silting, Admini
tion, Construction, Construction costs, Admini
tive Costs, Government supports, Governm
finance, Financing, Sea walls, Shores, Bulkh
Riparian land, Assessments, Cost repayment.
Identifiers: *Shore erosion control districts.

To protect and preserve the shorelines of M
land, the State Department of Natural Resourc
authorized to develop a program of shore ero
control. The Department may initiate program

ate the public concerning erosion, review peti- for formation of shore erosion control dis- assist property owners in designing and con- ing erosion control projects, and administer rosion control loan fund. Any owner of pro- abutting state waters may apply for assistance nore erosion control project. Projects shall be ed priority based on the rate of erosion, nt of resulting silt, and probable public its of the project. Upon the Department's mmendation, the Board of Public Works may ish a shore erosion control district, and all rty owners in the district must participate in a ct. Technical assistance and advice to proper- ners will be paid by the state. A construction und is created to provide interest-free loans se seeking to build erosion control projects. oans shall be repaid by special tax assessments e benefited property. The maintenance of eted projects shall be the sole responsibility property owners. (Liptak-Florida)
05492

RN RIVER WATERSHED--SEDIMENT WASTE CONTROL.

ode Ann art 66C, secs 411AE thru 411AO 1970).

ptors: *Maryland, *Sediments, *Waste al, *Water pollution control, Legislation, , Water pollution, Pollution abatement, quality control, Standards, Regulation, s, Effluents, Sewage effluents, Watershed gement, Sewage disposal, Silts, Conservation, l resources, Permits, Construction, Environ- l effects, Governments, Administration, Ad- rative agencies.

ncies or persons planning new sewage treat- or disposal facilities in the Severn River hed must meet the water quality standards the State Department of Water Resources, Department of Health, and county health de- nts. All owners and operators of existing al plants not meeting the above standards ubmit an improvement plan to the Health tment, and the plan shall provide that all im- nents be completed within three years. If any or operator fails to submit a plan or to con- the necessary improvements, the county or ay make the improvements and may hold the and operator liable for the costs. The county department shall take monthly water sam- all sewage discharges and send copies of the s to the State Department of Health, and rge of raw sewage or other waste in the river nibited. Any grading, excavating, or filling rst be approved by the soil conservation dis- nd regardless of any zoning or planning con- he county or city may not issue permits for uction without such approval and other as- es that the construction will not contribute pollution or silting of the river. (Liptak-
)
05493

ISHIP'S AUTHORITY TO REQUIRE CON- ONS INTO ABUTTING WATER SUPPLY EMS.

's Penn Legislative Service, Act No 97

ptors: *Pennsylvania, *Water supply, *Mu- water, *Cities, Local governments, Water y, Distribution systems, Water conveyance, districts, Water works, Domestic water, water, Industrial water, State governments, roperty, Land tenure, Cost repayment, Con- on costs, Reimbursable costs, Payment, Ad- ation, Legislation, Legal aspects, Remedies.

hips may require property owners to connect ater supply systems abutting their property. he refusal of a property owner to make such tions, townships are empowered to enter nstruct such connections. In case of default in the monthly installment payments imposed for such connection by the township, the entry of a municipal lien against the abutting property is authorized. Industries and farms having their own water supply systems for uses other than human consumption are excepted. (Earl-Florida)
W71-05494

MUNICIPALITIES--SEWAGE DISPOSAL SYSTEMS--FINANCE, CONSTRUCTION AND OPERATION.
NJ Session Law Service Ch 209 (1970).

Descriptors: *New Jersey, *Sewage districts, *Local governments, *Coordination, Legislation, State governments, Institutional constraints, Inter-agency cooperation, Public utility districts, Administration, Administrative agencies, Adoption of practices, Sewage treatment, Sewage, Cities, Legal aspects, Political aspects.

Municipalities and counties, with the consent and approval of sewerage and municipal utilities created by them, are authorized by this legislation to engage in cooperative efforts to construct and extend facilities for the collection, treatment, and disposal of sewage. Such cooperative efforts undertaken before this enactment are validated, ratified, and confirmed. (Earl-Florida)
W71-05495

INTERSTATE SANITATION COMMISSION--TRI-STATE COMPACT--WATER QUALITY STANDARDS.
NJ Session Law Service Ch 212 (1970).

Descriptors: *New Jersey, *Interstate compacts, *Interstate commissions, *Water quality control, Legislation, Water pollution control, Non-structural alternatives, Administration, Administrative agencies, Standards, Regulation, Coordination, Interstate, Political aspects, Classification, Water analysis, Water quality, Effluents, Administrative decisions, State governments, Legal aspects.

The Interstate Sanitation Commission, by virtue of this legislation, is empowered to develop and place in force water classification and effluent standards within the Commission's tri-state jurisdiction. Such standards are required to be based on present or intended uses of the water in question and accompanied by regulations governing the quality of the effluents and receiving waters. Classifications made pursuant to this legislation must meet the water and related land resource plans and pollution-control plans of the signatory states. Such classifications must also comply with the procedural requirements of federal law. (Earl-Florida)
W71-05496

FISH--BAIT AND LURE (RESTRICTIONS ON THE POSSESSION OF CERTAIN FISHING LURES).
New Jersey Session Law Service Ch 150 (1970).

Descriptors: *New Jersey, *Baits, *Fishing, *Fishing gear, Fish conservation, Bait fishing, Fly fishing, Cold-water fishing, Sport fishing, Regulations, Legal aspects, Legislation, Fish management, Fish attractants.

No person while angling in designated waters may possess any natural bait or artificial fishing lures other than those specified as legal. Violation is punishable by fine. (Earl-Florida)
W71-05497

TOWN OF PALM BEACH V CITY OF WEST PALM BEACH (CITY'S POWER TO CONDEMN OTHER CITY'S PROPERTY FOR SEWAGE DISPOSAL PURPOSES).
239 So2d 835-840 (4th DCA Fla 1970).

Descriptors: *Florida, *Eminent domain, *Sewers, *Cities, Sewage disposal, Sewage, Outlets, Pipes, Pipelines, Condemnation, Sewage treatment, Governments, Conveyance structures, Outlet works, Oceans, Public health, Water pollution, Public utilities, Treatment facilities, Gases, Legal aspects, Right-of-way.

Plaintiff city brought action to condemn defendant town's property for the construction of a pipeline and ocean outfall. The pipeline and outfall were to be a part of plaintiff's sewage disposal system. Plaintiff also sought land for a gas-removal vault to extract gas from the pipeline, thus preventing possible airlocks. Defendant's town objected and contended that the city had no authority to acquire property within another municipality by eminent domain, that land for the gas-removal vault could not be acquired without defendant's consent, and that the construction of the ocean outfall was against public policy. Denying the town's petition for certiorari, the Fourth District Court of Appeal of Florida noted that statutes clearly gave the city power to condemn property within another municipality for sewage transmission lines. Moreover, the gas vault was such an integral part of the transmission system as to be within plaintiff's eminent domain power. The court also held that even though ocean outfalls are subject to regulation by the state and must meet stringent public health requirements, they are not against public policy per se; they are thus within a city's eminent domain power. (Liptak-Florida)
W71-05498

FARR V LEACH (REMEDY FOR REFUSAL TO CONSTRUCT DIVERSION DITCH ORDERED BY COUNCIL).
134 A 594-595 (Vt 1926).

Descriptors: *Vermont, *Remedies, *Legislation, *Floods, Cities, Streams, Flood protection, Flood routing, Floodwater, Overland flow, Rain, Storm runoff, Water injury, Ditches, Bypasses, Diversion structures, Drainage engineering, Water conveyance, Compensation, Payment, Cost repayment, Adjudication procedure, Judicial decisions, Legal aspects, Administrative agencies.

Plaintiff lower landowner sued defendant upper landowner in tort. Plaintiff's meadow was frequently flooded by a brook flowing over defendant's higher land. Defendant refused to cooperate with plaintiff to divert the brook, so plaintiff petitioned the municipal council under a statute authorizing the council to order diversion and apportion the cost between upper and lower owners. Another statute provided that if a party so ordered did not accomplish diversion, another party of record might enter upon the land of the first to construct a ditch to divert the water and demand payment therefor. The council ordered the plaintiff and defendant to construct portions of a ditch to divert the water. Defendant refused to construct his portion, whereupon plaintiff brought this action in tort for damages caused by defendant's refusal. Noting that plaintiff's complaint did not allege that his portion had been constructed, the Supreme Court of Vermont held that the statute provided the exclusive remedy for defendant's refusal and that, therefore, a tort action would not lie. Plaintiff's only remedy was to bring an action for payment after constructing defendant's portion of the ditch. (Hart-Florida)
W71-05504

GORDON V PETTEY (DAMAGES AND INJUNCTION FOR LANDSLIDES CAUSED BY LANDFILL ON UPPER SLOPE).
291 Pa 258, 139 A 914-916 (1927).

Descriptors: *Pennsylvania, *Remedies, *Landfills, *Landslides, Debris avalanches, Retaining walls, Soils, Drains, Stratigraphy, Judicial decisions, Legal aspects, Rain water, Rainfall, Percolating water.

Plaintiff lower landowner brought action for damages caused by defendant upland owner's land-

fill and sought an injunction to compel defendant to remove the fill. Defendant filled in his land without providing retaining walls or drains, causing a landslide which damaged plaintiff's property. The trial court found that the fill caused the slide by its pressure upon the underlying strata. Defendant contended that the slide was caused by rain water which percolated through and undermined the soil. Since plaintiff had specifically advised defendant of the danger, the Supreme Court of Pennsylvania held defendant liable. However, since plaintiff had not shown that further slides were likely, the court determined that an injunction compelling defendant to remove the fill or provide drains and retaining walls was improper in light of the inordinate expense which would be entailed by defendant's compliance. (Hart-Florida)
W71-05511

THE CANADIAN ARCTIC WATERS POLLUTION PREVENTION ACT: NEW STRESSES ON THE LAW OF THE SEA,
Wisconsin Univ., Madison. School of Law.
Richard B. Bilder.
Michigan Law Review, Vol 69, No 1, November 1970. 54 p.

Descriptors: *Pollution abatement, *Arctic Ocean, *Law of the sea, Legislation, Jurisdiction, Boundaries, International law, Water pollution control.
Identifiers: *Canada, *The Canadian Arctic Waters Pollution Prevention Act, Shipping zones, Fishing zones.

The Canadian Arctic Waters Pollution Prevention Act was approved June 17, 1970. This act assures Canada's jurisdiction to regulate shipping zones to 100 nautical miles off her coasts and authorizes Canada to establish exclusive fishing zones adjacent to the coasts but beyond the new 12 mile territorial sea. The act also considers international law and policy regarding the legal regime of Arctic waters, contiguous zones, archipelagoes waters and passage in international straits. These waters and the coastal states are considered regarding pollution prevention, law-of-the-sea and international agreement. (Ensign-PAI)
W71-05515

GIBSON V HOFFMAN (DISPUTE OVER OWNERSHIP OF MARSH MEADOW).

310 Pa 51, 164 A 783-786 (1933).

Descriptors: *Pennsylvania, *Boundaries (Property), *Boundary disputes, *Land tenure, High water mark, Low water mark, Riparian land, Rivers, Banks, Dikes, Marshes, Real property, Legal aspects, Judicial decisions.

In an action in ejectment over riparian land, a deed conveying '5 acres of marsh meadow bounded by river' was construed by the Supreme Court of Pennsylvania to convey adjacent land between low and high water marks. A subsequent deed describing the boundary as the top of the river bank, which was an artificial bank, was also held to include land between high and low water marks. Possession of the uplands was sufficient possession of the adjacent flat lands. (Hart-Florida)
W71-05529

TOVALOP - ITS ORIGIN, DEVELOPMENTS, STATUS, AND OBJECTIVES,
International Tanker Owners Pollution Federation, Ltd., London, England.
For primary bibliographic entry see Field 05G.
W71-05532

KILLMASTER V ZEIDLER (ADVERSE POSSESSION OF RIPARIAN TRACT AND ITS ACCRETIONS).

269 Mich 377, 257 NW 721-723 (1934).

Descriptors: *Michigan, *Land tenure, *Riparian land, *Accretions (Legal aspects), Real property, Prescriptive rights, Riparian rights, Saw mills, Judicial decisions, Legal aspects.

In an action to quiet title to a tract of riparian land, where the primary issue was adverse possession of the upland, the Supreme Court of Michigan held that accretions belonged to the owner of the riparian land to which the accretions attached. (Hart-Florida)
W71-05536

CONGRESS PASSES WATER QUALITY IMPROVEMENT ACT OF 1970.
In: Man's Control of the Environment, Congressional Quarterly, Washington, DC, p 28-31.

Descriptors: *Legislation, *Oil wastes, *Mine wastes, *Ships, *Sewage, *Water pollution control, Cleaning, Federal government, Grants.
Identifiers: *Liability, Great Lakes, Alaska.

The Water Quality Improvement Act of 1970 was passed by Congress and signed into law April 3. The action by the House and Senate of the bill (HR 4148) is traced from its inception to the final action. The Law declares as U.S. policy that there should be no oil discharged into navigable waters of the U.S. or adjoining shores. Petroleum companies are made liable for up to $14 million in oil spill cleanup costs. Control over hazardous polluting substances, sewage from vessels, mine water pollution, Great Lakes pollution are also covered by this law. Training grants and scholarships for antipollution programs are included. The Law also created an office of Environmental Quality to act as a staff for the President's Council on Environmental Quality. (Ensign-PAI)
W71-05542

U.S. AND UN DEBATE MAN'S USES AND ABUSES OF THE SEA.

In: Man's Control of the Environment, Congressional Quarterly, Washington, DC, p 77-81.

Descriptors: *Exploitation, *Preservation, *International waters, *Industrial wastes, *Legislation, Fisheries, Mineral industry, Continental shelf, United Nations.

International efforts to regulate exploitation and protect marine resources are discussed. Organization, administration and the relationships between national and international authority are considered. (Ensign-PAI)
W71-05543

RIM OF THE SEA BECOMING CROWDED AND DIRTY.
In: Man's Control of the Environment, Congressional Quarterly, Washington, DC, p 21-27.

Descriptors: *Federal government, *Legislation, *International law, *Political aspects, *Water pollution control, *Coasts, *Great Lakes, *International waters, *National seashores, *National lakeshores, Oil, Accidents, Construction, Dredging, Sewage.

Offshore oil spillls, building developments, dredging, sewage and industrial waste are problems to be faced by coasts around the world. The rim of the sea is a natural resource which can no longer be taken for granted as either a food source or for aesthetics and amusement. The major mishaps in oil transporting and drilling are traced along with other pollution causes. The politics of pollution, federal legislation, and international agreements are discussed. Ideas for development, preservation, pollution control and remedies to coastal problems are presented. (Ensign-PAI)
W71-05544

THE FEDERAL-STATE PARTNERSHIP MANAGING THE COASTAL ZONE,
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-05546

SCHALLER V TOWN OF FLORENCE (VA TION OF DEDICATION OF BEACH PUBLIC).

259 NW 529-535 (Minn 1935).

Descriptors: *Minnesota, *Lakes, *Meand *Boundaries (Property), Mississippi River, Rip an rights, High water mark, Low water m Shores, Lake shores, Beaches, Littoral, Recreat Boats, Ships, Judicial decisions, Legal aspects.

Plaintiff riparian landowner brought action aga defendant town to have a plat vacated and lands dedicated therein vested in plaintiff. disputed littoral land had been dedicated to public for use as a steamboat landing. However, land was abandoned for that purpose and was as a bathing beach. From a lower court finding the beach could be used by the public only f steamboat landing and holding that, since this was abandoned, the public no longer had righ the beach, defendant appealed. The Supr Court of Minnesota determined that the dedica intended to convey to the public all of the be the steamboat provision being only an additi burden upon the beach. Stating that a meander is not necessarily the shoreline, the court cluded that the dedication extended to the wa edge rather than the meander line. Since vaca of the dedication and plat would not be in the interests of the general public, the court de plaintiff's petition, reversing the lower court's d sion. (Hart-Florida)
W71-05583

CROUCHER V WOOSTER (DISPUTE O OWNERSHIP OF LITTORAL LAND BETW HIGHWAY AND LAKE).
271 Mich 337, 260 NW 739-742 (1935).

Descriptors: *Michigan, *Riparian land, *Ripa rights, *Land tenure, Boundaries (Prope Lakes, Recreation, Littoral, Real property, Bo dary disputes, Legal aspects, Judicial decisi Shores, Highways.

Plaintiff riparian landowner brought action to q title against defendant upland landowner. Plai claimed title to a narrow strip between a lake a highway. Defendant's lot was directly across highway from plaintiff's. Defendant claimed rip an rights in plaintiff's land through mesne veyances from their common grantor. Plai claimed title in fee through mesne conveya from their common grantor; however, the veyance to plaintiff's predecessors occurred the conveyance of riparian rights to defend predecessors. The Supreme Court of Michigan served that defendant held the same riparian ri as if there were no intervening highway. Since conveyance through defendant's chain of title curred first, the court held that no title passe plaintiff. The court furthermore held that an ass ment of the residue from the common gran decedent estate also passed no title. (Hart-Flori
W71-05620

A METHODOLOGY STUDY TO DEVE EVALUATION CRITERIA FOR WILD A SCENIC RIVERS,
Idaho Univ., Moscow. Water Resources Rese Inst.
For primary bibliographic entry see Field 06B.
W71-05623

STATE V MONTELEONE (STATE'S POL POWER TO CONSERVE FISH IN

TERS).

La 437, 131 So 291-293 (1930).

criptors: *Louisiana, *Fish, *Permits, *Fish servation, Legislation, Commercial fishing, Fish agement, Regulation, State governments, State sdiction, Judicial decisions, Governments, ural resources, Wildlife management, Commer- fish, Taxes, Preservation, Public rights, Ad- istrative agencies, Legal aspects.
tifiers: Constitutionality.

endant was convicted of violating a statute iring wholesale fish dealers to procure a se from the Louisiana Department of Conser- on. Defendant contended that the license irement was an exercise of the state's taxing er. However, the title of the statute indicated the purpose of the act was to conserve and pro- fish. Defendant contended that the statute was efore unconstitutional in that the objects of the te were broader than its title. In denying de- ant's appeal, the Supreme Court of Louisiana that a dealer in commercial fish is engaged in a ness which is within the control of the state r its police power. The fish are owned by the in its sovereign capacity and are a part of the 's natural resources. When the privilege to hase commercial fish for resale is granted, the may exact such charges and impose such con- ns as it may deem necessary to secure the ervation and conservation of its property. The se is not a tax for revenue, but a condition ribed by the sovereign for the divestiture of its (Smiljanich-Florida)
-05627

EPE V TOWN OF AMERICA (DAMAGES TO ALTERATION OF DRAINAGE TEMS BY TOWN).

NW 158-159 (Minn 1928).

riptors: *Minnesota, *Surface drainage, inage systems, *Surface waters, Surface ru- Drains, Culverts, Ditches, Embankments, ways, Maintenance, Diversion, Discharge ter), Flood damage, Floods, Rainfall, ages, Crops, Legal aspects, Judicial decisions, s.

tiff landowners sought to enjoin defendant s from maintaining culverts and embankments eby surface waters were collected and ted from one drainage system into another, by flooding plaintiff's lands and damaging his . The towns, during improvement of a way, had dammed the outlet in one ditch so waters were diverted to another ditch. Plaintiff granted injunctive relief and damages. Defen- appealed an order denying a new trial. The eme Court of Minnesota affirmed. The nce supported the finding that defendants gfully altered the drainage systems, discharg- ore surface water into one ditch and thereby ing and damaging plaintiff's land. In improv- nd maintaining public highways, towns are ut authority to change substantially or inter- with the operation of existing public drainage ns. (Duss-Florida)
05628

V CITY OF JACKSON (CITY'S RESPON- LITY FOR CULVERTS).
o 295-296 (Miss 1934).

riptors: *Mississippi, *Culverts, *Obstruction w, *Flood damage, Floodwaters, Floods, control, Streamflow, Streams, Creeks, ing waters, Civil engineering, Legal aspects, ial decisions, Water law, Adjudication dure.

iff sought to recover damages caused by the d negligence of defendant city. The damages ed when water overflowed plaintiff's proper- ty. Plaintiff's premises bordered a natural watercourse which flowed under a city street. The city provided a double-barrel culvert for the watercourse under the street. In the trial, engineers testified that this culvert was adequate, but further stated that such double-barrel culverts were more likely to be obstructed than one culvert the size of the two. The jury was instructed that the city was only required to provide a sufficient outlet to handle the ordinary water of the stream and that the city was not liable for damages caused by the collection of debris unless placed there by the city. On appeal, the plaintiff contended that this instruction was error. The Supreme Court of Mississippi reversed. It was a question of fact as to whether the drainage was adequate. The city was not relieved of its duty to keep the culvert free of obstructions by the fact that such obstructions were not placed there by the city. (Robinson-Florida)
W71-05631

HUDSON V TOWN OF MORGANTON (REGULATIONS DEPRIVING OWNERS OF FULL USE OF WATERSHED LAND).
171 SE 329-330 (NC 1933).

Descriptors: *North Carolina, *Watersheds (Basins), *Eminent domain, *Compensation, Damages, Local governments, Cities, Governments, Small watersheds, Land use, Remedies, Watershed management, Legal aspects, Judicial decisions, Land, Real property, Condemnation, Easements, Farms, Land management, Management, Environmental sanitation.

Defendant town established a watershed and promulgated rules prohibiting trespass on watershed property and requiring owners of watershed lands to take certain steps to insure sanitary conditions. Plaintiff claimed that such regulations deprived her of the full use of her farm land without compensation. The Supreme Court of North Carolina affirmed a lower court judgment for defendant. Defendant acquired no easement on plaintiff's land, nor did it trespass thereon physically. Where defendant did not physically invade plaintiff's property, plaintiff's apprehension of prosecution for violating defendant's rules deprived her of no rights requiring compensation. Moreover, plaintiff admitted that defendant provided her with no instructions as to sanitation. Since such instructions were required by statute, plaintiff could not have been subjected to penalty for breaking the regulations. (Dye-Florida)
W71-05635

JONES V EUPER (STATE'S TITLE TO ISLANDS IN NAVIGABLE STREAMS).
182 Ark 969, 33 SW2d 378-379 (1930).

Descriptors: *Arkansas, *Prescriptive rights, *Navigable rivers, *Islands, Boundary disputes, State jurisdiction, Boundaries (Property), Accretion (Legal aspects), Streams, Stream erosion, Accelerated erosion, Riparian rights, Alteration of flow, Diversion, Legislation, State governments, Judicial decisions, Legal aspects, Land tenure, Navigable waters.

Plaintiff landowner sued defendant sand and gravel company for damages to an island in a navigable stream. Plaintiff contended that defendant's operations caused a change in the river's course, thereby damaging plaintiff's island. Defendant contended that plaintiff had failed to establish his title to the island, arguing that plaintiff had failed to follow the correct procedure in acquiring title to the island from the state. Affirming a trial court decision for defendant, the Supreme Court of Arkansas noted that plaintiff's only possible claim to the island was by adverse possession. A statute provided that all islands formed subsequent to the admission of the state into the Union were the property of the state, subject to sale in the manner provided by the statute. As plaintiff had failed to follow this procedure, he could not alternatively claim title to the island through adverse possession. Title to state-owned islands in navigable streams cannot be acquired by adverse possession. (Smiljanich-Florida)
W71-05638

KEITH V DRAINAGE DIST NO 7 (LANDOWNER'S ACCRUAL OF CAUSE OF ACTION FOR TAKING OF PROPERTY).
36 SW2d 59-64 (Ark 1931).

Descriptors: *Arkansas, *Drainage districts, *Eminent domain, *Compensation, Reservoirs, Reservoir sites, Condemnation, Drainage programs, River flow, Diversion, Riparian rights, Submergence, Flood control, Natural flow doctrine, Alteration of flow, Administration, Local governments, State governments, Judicial decisions, Legal aspects, Flooding.

Plaintiff landowner sued defendant drainage district for damages caused by defendant's taking of plaintiff's land. Defendant had diverted the waters of a river from their natural course and impounded the waters in a reservoir, damaging plaintiff's land by submerging fertile ground. Defendant contended that plaintiff's land was sold prior to the accrual of the cause of action. In reversing the trial court's judgment for defendant the Supreme Court of Arkansas noted that plaintiff's cause of action accrued upon the defendant's filing of plans for the drainage district, which indicated that plaintiff's lands would be submerged. Where there is any invastion of private property by lawful authority for a public use, and the property is damaged thereby, there is a taking of land requiring the public to compensate the landowner for the deprivation of the beneficial use of his property. For purposes of determining right to compensation, the taking of private property occurs when the landowner's petition is filed. A subsequent diverstiture of his title does not work a forfeiture of plaintiff's cause of action. (Smiljanich-Florida)
W71-05642

DENNIG V GRAHAM (INJUNCTION TO PREVENT FISHING IN PRIVATE STREAM AND SPRING).
59 SW2d 699-703 (Mo App 1933).

Descriptors: *Missouri, *Remedies, *Fishing, *Adjudication procedure, Recreation, Fish stocking, Fly fishing, Fish, Springs, Streams, Rivers, Legal aspects, Judicial decisions, Navigable waters, Nonnavigable waters, Ownership of beds.

Plaintiff riparian landowner sought to enjoin defendant sportsman from fishing in his stream. Plaintiff owned a large tract upon which was located a large spring. The spring water formed a non-navigable stream which flowed into a nearby river. The spring and stream were stocked with fish at plaintiff's expense. Defendant had repeatedly fished the stream in spite of plaintiff's request for him not to do so. Notwithstanding defendant's testimony that he did not intend to fish the stream in the future, the evidence was held sufficient to show that defendant intended to fish the stream, indicating a reasonable probability of injury to plaintiff. Defendant contended that plaintiff's right to have him prosecuted for trespass was an adequate remedy at law. This contention was rejected. Concluding that plaintiff was threatened with irreparable harm, the Spring Court of Appeals of Missouri granted the injunction. (Hart-Florida)
W71-05661

SUPERIOR COAL AND BUILDERS SUPPLY CO V BOARD OF EDUC (LIABILITY FOR ALTERATION OF NATURAL LAND DRAINAGE).
260 Ky 84, 83 SW2d 875-876 (Ct App Ky 1935).

Descriptors: *Kentucky, *Surface drainage, *Historic flood, *Excessive precipitation, Rainfall, Artificial watercourses, Alteration of flow, Natural streams, Watercourses (Legal), Drainage, Drainage water, Surface waters, Floods, Runoff,

Rainfall-runoff relationships, Rainfall intensity, Damages, Riparian rights, Natural flow doctrine, State governments, Legal aspects, Judicial decisions.
Identifiers: *Negligence, *Act of God.

Plaintiff company sued defendant state agency for damages to plaintiff's land. Plaintiff contended that defendant substituted an artificial drain for a natural watercourse which, in periods of heavy rainfall, was inadequate in size. Plaintiff contended that water subsequently accumulated on its land, flooding and destroying it. Defendant contended that there was no allegation of negligence in plaintiff's petition and that the rains referred to were of an extraordinary nature. In affirming the trial court dismissal of plaintiff's petition, the Court of Appeals of Kentucky noted that the term 'heavy rainfall' must be construed as extraordinary rainfall, for which defendant would not be liable in the absence of negligence. As plaintiff had not alleged negligence by the defendant, its petition was properly dismissed. A landowner is entitled to the natural drainage of his land. However, in absence of negligence in the installation or maintenance of a substitute drainage for a natural watercourse, liability is limited to the result of ordinary rains, not an Act of God. (Smiljanich-Florida)
W71-05668

POLITICAL GEOGRAPHY OF THE ISRAELI-SYRIAN BOUNDARY DISPUTE, 1949-1967,
State Univ. of New York, Buffalo.
J. S. Haupert.
Professional Geographer, Vol 21, No 3, p 163-171, May 1969. 4 fig, 15 ref.

Descriptors: *Boundary disputes, *Political aspects, *Arid lands, *Geographical regions, *Political constraints, Water resources development, History, Economic impact, Social impact, Maps, Water resources, Water control, Legal aspects, Water rights, Riparian rights, Boundaries (Property), Foreign countries.
Identifiers: *Israel, *Syria, *Middle East.

Boundary claims arising from extended hostilities between nations have been major factors in political disputes since World War II. The 18-year series of conflicts between Israel and Syria along their politically contrived borders have largely involve water ways and riparian rights. Three demilitarized zones were imposed over territory allocated to Israel by the UN partition plan and the armistice agreement: (1) northern, near Kibbutz Dan, through which the River Dan flows to the Jordan River, (2) central, west of the Jordan River near the B'not Yaakov bridge and (3) southern, located in part of the Yarmuk 'triangle' southeast of Lake Kinneret. Between 1951-53, Israel embarked upon 2 major water projects--drainage of the Hula swamps and diversion of the Jordan River. The Hula Valley alone counts for 60% of all of Israel's water resources. The Syrians objected to the Hula project because the drainage canal would traverse the demilitarized zone and infringe upon Arab cultivation rights, as would the river diversion project. Over the years both countries supported accelerating claims by their nationals on extension of cultivation in the zones. Work on a hydro-electric project near the B'not Yaakov bridge elicited objections because it endangered traditional Syrian right of access for livestock and irrigation. Water transfer from Lake Kinneret to the Negev Desert without Arab cooperation or negotiation over fishing and cultivation rights led to retaliatory raids into Israel and artillary shelling from the Golan Heights. All of this was part of a larger political and social struggle, which is described in detail. (Casey-Arizona)
W71-05711

INTEGRATION OF CONNECTICUT WATER RIGHTS LAWS AND POLLUTION CONTROL LAWS,
Connecticut Univ., Storrs.
Theodore Pocht, Robert L. Leonard, and Robert Reis.
Available from NTIS as PB-198 000, $3.00 in paper copy, $0.95 in microfiche. Completion Report, November 17, 1969. 18 p. OWRR Project A-012-CONN (4).

Descriptors: *Connecticut, *Water pollution control, *Water rights, *Water utilization, Legislation, Legal aspects, Judicial decisions, Industrial water, Industrial wastes, Municipal water, Municipal wastes, Riparian rights, Discharge (Water), Sewage, Environmental effects, Regulation, Costs, Benefits, Surface waters, Groundwater, Research and development, Recreation, Water pollution, Administrative agencies.

As a guide for integration of Connecticut water rights laws and pollution control laws, the research project described in these reports examines: (1) the adminstrative structure for regulation of water resources, (2) case law on water resources, (3) the economics of water utilization, (4) the effectiveness of riparian rights in protecting recreational uses and environmental values, and (5) the efficacy of present pollution control laws and practices. The project attempts to provide a detailed background of Connecticut water law, criteria for evaluating water law and institutions, and a guide for needed changes in statutory law and administrative structure. The ability of administrative agencies to deal with water pollution problems has been improved by the passage of the Connecticut Water Pollution Control Act of 1967. Case law has not treated many areas of water use, but has developed classifications of water and rendered decision on such matters as riparian rights, municipal water supply and pollution problems. At present there is no economic need for a redefinition of water rights. There is a need for more economic incentives in pollution control laws and stronger regulation to assure adequate streamflow and reduce waste discharges. (Duss-Florida)
W71-05718

WATER POLLUTION PREVENTION REQUIREMENTS IN RELATION TO FARM-WASTE DISPOSAL,
Thames Conservancy (England). Chief Purification Officer.
For primary bibliographic entry see Field 05G.
W71-05753

KELLY V KANSAS CITY BLDG AND LOAN ASS'N (LIABILITY TO ADJOINING LANDOWNER FOR OVERFLOW OF SEPTIC TANK).

86 SW2d 975-978 (Ct App Mo 1935).

Descriptors: *Missouri, *Septic tanks, *Public health, *Damages, Judicial decisions, Legal aspects, Cesspools, Domestic wastes, Sewage bacteria, Gases, Mosquitoes, Human diseases, Environmental sanitation, Safety, Sanitary engineering, Social aspects, Organic wastes, Sewage, Sewage treatment, Waste disposal, Real property, Odor, Fouling, Air pollution, Adjudication procedure.

Plaintiff landowner sued defendant company for injuries caused by overflow onto plaintiff's property from defendant's septic tank. Plaintiff contended the defendant's septic tank was negligently allowed to drain onto plaintiff's property, emitting four gases and odors, and attracting flies and mosquitoes. Plaintiff contended that as a result she suffered permanent injury to her health. Defendant generally denied the allegations and contended that plaintiff's injuries were caused by her privy vault or cesspool which had not been cleaned properly and which allowed water to run on the ground. The Kansas City Court of Appeals affirmed a jury verdict and judgement for plaintiff stating that the questions of defendant's negligence and plaintiff's contributory negligence were for the jury. If overflow from a septic tank causes injury to an adjoining landowner, a factual determination of negligence by the trial court must be respected by an appellate court. (Smiljanich-Florida)
W71-05772

ACCESS--ITS EFFECT ON AREA GROWT AND ENVIRONMENTAL QUALITY.
Washington State Water Research Center, Pu man.
For primary bibliographic entry see Field 06B.
W71-05776

ACCESS TO WATER,
Washington State Environmental Quality Di Olympia.
Charles Roe.
In: 'Access--Its Effect on Area Growth and E vironmental Quality,' Central Washington Sta College, Ellensburg, Washington, May 15, 1970, 36-46. OWRR Project A-999-WASH (3).

Descriptors: *Legal aspects, Environment, Ecol gy, Natural resources, Conservation.
Identifiers: *Environmental policy, Environment quality, Water resources planning.

Water is one of the greatest natural resources in t state of Washington. Litigation over access water in the state is common and almost alwa bitter. These cases have involved cities, sportsme conservationists, and Indians. One case cited is th over Lake Chelan: A dam built on the lake cause thirty foot change in water level at various times the year. The court ruled that the public had a rig to use water for recreation when at its high lev but not to trespass privately-owned land when e posed by low level of water (Wilbour vs. Gallagh 1969). In 1967 the state legislature provided t Water Resources agency with authority to establi minimum flows and levels on lakes for the purpo of protecting fish and wildlife interests, aesthe values and water quality. The state administrati is now in the process of developing comprehensi sewerage drainage abatement plans. Washingt also cooperates with the national policy of not lowing water to be degraded below existing quali A Department of Ecology has been formed to de with all related problems efficiently. (See al W71-05776) (Wray-Chicago)
W71-05779

The Differential Effects of Advanced Communi tion, Transportation, Centralization, and Afflue on Disaster Relief in a Kentucky Town,
Kentucky Univ., Lexington.
C. Ronald Rosensteil.
Mimeographed 1970. 15 p, 2 ref. OWRR Proje A-022-KY (5).

Descriptors: *Social change, Social aspects, Co munication, Kentucky, *Disasters.
Identifiers: *Regional development, Social syste Citizen participation.

The area studied is Mahogany, a Kentucky coun with a population of approximately 10,000. T county seat, Disasterville, has a fairly stable pop lation of 2500. In the county there has been a co tinuing shift of economic and cultural focus aw from the small towns and toward the county s and the large metropolitan area thirty miles aw Part of this shift of focus is due to the independen and mobility of people, which is the result of p sonalized efficient transportation made possible the automobile. Technological advancement transportation and communication along with concomitant developments in centralization and fluence have affected the county and its citize This report shows how these variable differentia affect disaster-related behavior and relief. A t nado struck and seriously damaged Disasterville 1968. Word of the disaster spread quickly by rad television, phone, and car, though the informati was sometimes distorted. Great amounts of flowed into the town, but a systematic scheme relief was lacking. An education program on nature of tornadoes and action to be taken in em gencies was advised for the town. (Wray-Chicag W71-05782

A DIGEST OF ENVIRONMENTAL POLLUTI LEGISLATION IN CANADA, WATER.
Canadian Industries Ltd., New Toronto (Ontario

primary bibliographic entry see Field 05G.
1-05804

LLUTION OF LAKE ERIE, LAKE ONTARIO D THE INTERNATIONAL SECTION OF THE LAWRENCE RIVER. VOLUME I - SUMMA-

rnational Lake Erie Water Pollution Board; International Lake Ontario-Saint Lawrence er Water Pollution Board.
primary bibliographic entry see Field 05G.
1-05805

LLUTION OF LAKE ERIE, LAKE ONTARIO D THE INTERNATIONAL SECTION OF THE NT LAWRENCE RIVER, VOLUME II - KE ERIE.

rnational Lake Erie Water Pollution Board; International Lake Ontario-Saint Lawrence er Water Pollution Board.
primary bibliographic entry see Field 05G.
1-05806

LLUTION OF LAKE ERIE, LAKE ONTARIO D THE INTERNATIONAL SECTION OF THE NT LAWRENCE RIVER. VOLUME III - KE ONTARIO AND THE INTERNATIONAL TION OF THE SAINT LAWRENCE RIVER.

rnational Lake Erie Water Pollution Board; International Lake Ontario-Saint Lawrence er Water Pollution Board.
primary bibliographic entry see Field 05G.
1-05807

ERNATIONAL LEGAL CONFERENCE ON RINE POLLUTION DAMAGE, FINAL ACT THE CONFERENCE WITH ATTACHMENTS LUDING THE TEXTS OF THE ADOPTED NVENTIONS.

r-Governmental Maritime Consultative Organization, London.
primary bibliographic entry see Field 05G.
1-05810

BLIC USE OF RESERVOIR AREAS--CAMP-

ps of Engineers, Washington, D.C.

eral Register, Vol 35, No 105, p 8447, May 0. 1 p.

criptors: *Reservoir sites, *Camping, *Recrea- facilities, *Camp sites, Federal government, inistrative decisions, Tourism, Reservoirs, od control, Reservoir operation, Recreation, ty, Public benefits, Non-consumptive use, ed States, Regulation, Administration, Legisla- Adoption of practices, Administrative agen- Social aspects, Legal aspects.

uant to the amended Flood Control Act of 4, the Secretary of the Army herein sets forth lations concerning the public use of reservoir s as camp sites. Subject to limitations, camping eservoir sites is consistent with the public in- st and with the operation and maintenance of reservoirs. Camping is permitted only in certain gnated areas. The length of stay is limited to ain times, dependent upon the type of camping the available facilities. Provision is made for ping fees. Campers may not install permanent ities, nor may camping equipment be aban- ed or left unattended for 48 hours or more. per camping sanitation must be observed. The ling of camp and grass fires is regulated. (Smil- h-Florida)
-05813

CUTIVE ORDER 11523, ESTABLISHING NATIONAL INDUSTRIAL POLLUTION TROL COUNCIL.

Order No 11523, Federal Register, Vol 35, 1, p 5993-5994, April 1970. 2 p.

Descriptors: *Industries, *Water pollution control, *Administrative agencies, *Water quality control, Pollution abatement, Supervisory control (Power), Federal government, Administration, Regulation, Administrative decisions, Jurisdiction, Decision making, Water pollution sources, Inter-agency cooperation, Legal aspects, Industrial production, Industrial wastes, Industrial plants, Environment, Environmental effects, Water pollution, Waste disposal, State governments, Local governments.
Identifiers: *National Environmental Policy Act.

In furtherance of the purpose and policy of the National Environmental Policy Act of 1969, the President of the United States in this executive order creates the National Industrial Pollution Control Council. The secretary of Commerce is given the responsibility of appointing the members of the Industrial Council, composed of representatives of business and industry. The Industrial Council shall advise on programs of industry relating to environmental quality. In particular its functions are to: (1) survey and evaluate industrial plans and actions in the field of environmental quality; (2) recommend solutions to the problems of the effects on the environment of industrial practices; (3) provide liason among members of the business and industrial community on environmental quality matters; (4) encourage business and industrial improvement in environmental quality; and (5) advise on environmental quality plans and actions of federal state and local agencies affecting industry. Provision is made for subordinate committees, administrative and staff service, compensation for members, and regulation of the Council's operation. (Smiljanich-Florida)
W71-05814

MARYLAND'S WETLANDS: THE LEGAL QUAGMIRE,
Stuart Marshall Salsbury.
Maryland Law Review, Vol 30, No 3, p 240-266, 1970. 27 p, 158 ref.

Descriptors: *Wetlands, *Maryland, *Coastal marshes, *Tidal marshes, Swamps, Salt marshes, Bogs, Standing waters, Surface waters, Bodies of water, Marshes, Aquatic environment, Aquatic habitats, Governments, State governments, Legislation, Legal aspects, Regulation, Water law, Riparian rights, Dredging, Landfills.

Dealing with the legal problems of Maryland's wetlands, this article begins with a historical review of title to lands under navigable waters, followed by a historical discussion of common law and Maryland statutory riparian rights. Wetlands include such areas as swamps or marshes permanently, temporarily, or intermittently submerged or inundated. The terms accretion and reliction are also defined. A new Maryland wetlands statute provides a legal and geographical definition of the term 'wetlands'. The statute furthers a new state policy of preserving these wetlands. Wetlands are broken down into state and private wetlands. The statute provides more stringent requirements for dredging and filling on state wetlands than on private wetlands. This statute conforms more to the common law than did previous statutory law, in that the riparian owner is entitled to natural accretions only. This article further discusses the procedural requirements and penalties provided by this new statute. The legal considerations of the wetlands statute are detailed under the following headings: uncompensated taking of private property, repeal of former riparian rights sections, and the public trust doctrine. (Robinson-Florida)
W71-05815

DANGER ZONE REGULATIONS (FORT MONROE, VIRGINIA).
Corps of Engineers, Washington, D.C.

Federal Register, Vol 35, No 80, p 6575, April 1970. 1 p.

Descriptors: *Rivers and Harbors Act, *Bays, Administration, *Regulation, Navigable waters, United States, Legislation, Administrative agencies, Decision making, Adoption of practices, Administrative decisions, Governments, Federal government, Legal aspects, Bodies of water.
Identifiers: *Forts, Administrative regulations.

Pursuant to the provisions of section 7 of the Rivers and Harbors Act of 1917, this regulation, promulgated by the Corps of Engineers, governs the danger zone in the Chesapeake Bay off Fort Monroe, Virginia. Passage of vessels through the area will not be prohibited at any time. Commercial fishermen will be allowed to fish within this area, but no loitering or anchoring for other purposes will be allowed. No firing will be allowed during periods of darkness or poor visibility. The Commander, Fort Monroe, Virginia, is responsible for providing an advance firing schedule to the Coast Guard, who will enforce this regulation. (Robinson-Florida)
W71-05816

EXECUTIVE ORDER 11528 (CHANGING THE JURISDICTION AND MEMBERSHIP OF THE NEW ENGLAND RIVER BASINS COMMISSION).

Exec Order No 11528, Federal Register, Vol 35, No 82, p 6695-6696, April 1970. 2 p.

Descriptors: *Water Resources Planning Act, *River basin commissions, *Jurisdiction, *Leadership, River basin development, Water resources development, Legislation, Water resources, Administration, Federal government, State governments, Legal aspects, Water utilization, Interstate commissions, Interstate compacts, Water supply, Water conservation, Water policy, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York.
Identifiers: *Executive orders.

By virtue of the authority vested in him by the Water Resources Planning Act, the President herein changes the jurisdiction and membership of the New England River Basins Commission. The Commission's jurisdiction shall consist of all or specified portions of the following states or areas: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York and Long Island Sound. The membership of the New England River Basins Commission shall consist of: (1) a chairman appointed by the President; (2) one member each from the Department of Agriculture, Department of the Army, Department of Commerce, Department of Health, Education and Welfare, Department of Housing and Urban Development, Department of the Interior, Department of Transportation, Atomic Energy Commission, and Federal Power Commission; (3) one member each from Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, and New York; and (4) one member from each interstate agency, created by interstate compact, whose jurisdiction extends to the waters of the specified areas. (Robinson-Florida)
W71-05817

AUTHORIZATION OF APPROPRIATIONS FOR COMMERCIAL FISHERIES RESEARCH AND DEVELOPMENT.

16 USCA sec 779b (Supp 1969) amending 16 USCA sec 779b (1964).

Descriptors: *Research and development, *Government finance, *Commercial fishing, *Grants, Fish establishment, Federal government, State governments, Legislation, Fish, Fish management, Fish conservation, Fisheries, Fish harvest, Administration, Legal aspects, Water resources development, Government supports, Regulation, Financing, Administrative agencies.

For the fiscal year beginning July 1, 1969, and for three succeeding fiscal years, 5 million dollars per year is appropriated for the Secretary of the Interior to carry out the purposes of this chapter. Also, $650,000 per year for the same period is to be made available to the states in such amounts as the Secretary may deem appropriate for the purposes of this chapter. The Secretary shall give preference to those states in which there is a commercial fishery failure resulting from natural or undetermined causes. Such funds are not to be used as grants for chartering fishing vessels. There is also appropriated $100,000 per year which shall be available for the Secretary to give to the state, in such amounts as he deems necessary, to develop new commercial fisheries. (Robinson-Florida)
W71-05818

ABANDONED MINE DRAINAGE CONTROL ACT OF 1970 (LAND RECLAMATION FOR WATER POLLUTION CONTROL).
Md Code Ann art 66c, secs 674a thru 674h (Supp 1970).

Descriptors: *Maryland, *Mine drainage, *Water pollution control, *Land reclamation, Mining, Mine wastes, Coal mine wastes, Strip mine wastes, Mine water, Water pollution sources, Water pollution, Pollution abatement, Land use, Water resource development, Land development, Legislation, Taxes, State governments, Surface drainage, Conservation, Revegetation, Public health.

In order to restore polluted state waters to the quality necessary to support fish and wildlife, recreation, and other beneficial uses, the Secretary of the Maryland Department of Natural Resources is authorized to acquire and rehabilitate land occupied or degraded by abandoned mines. The Secretary may take whatever action is necessary to prevent, control, and abate water pollution from such land. The Board of Public Works is authorized to issue Mine Reclamation and Water Quality Restoration Loan certificates for five million dollars and to sell them at public sale to the highest bidder. The proceeds of such loans are to be used exclusively for acquisition, improvements, or rehabilitation of abandoned mine property or for pollution control or treatment facilities. If the proceeds are used to rehabilitate privately owned land, the owner must contribute an amount at least equal to the resulting increase in the value of his land. An annual property tax is imposed to meet the interest and principal payments on the loan fund. The Secretary may backfill, grade, revegetate or seal mines, and control erosion and drainage to implement the purposes of the Act. Land acquired and rehabilitated may then be sold, retained, or transferred to a subdivision of the state. All proceeds from such sales shall constitute an Abandoned Mine Drainage Capital Fund to be used for the same purposes as the loan fund. The Department of Natural Resources may cooperate or undertake joint projects with other state agencies and political subdivisions and may procure any available federal assistance. (Liptak-Florida)
W71-05819

A STUDY OF THE RIPARIAN AND PRIOR APPROPRIATION DOCTRINES OF WATER LAW,
Georgia Univ., Athens. School of Law.
E. Ben R. Lancaster, and Bryan M. Storey.
Institute of Law and Government, School of Law, University of Georgia, Oct 1955. 204 p, 282 ref, append.

Descriptors: *Georgia, *Riparian rights, *Prior appropriation, *Natural flow doctrine, Alteration of flow, Artificial use, Civil law, Competing uses, Diversion, Domestic uses, Legal aspects, Judicial decisions, Legislation, Natural use, Ownship of beds, Reasonable use, Relative rights, Riparian land, Riparian waters, Water pollution, State governments, Appropriation, Preferences (Water rights), Administrative agencies, Beneficial use.

The two basic doctrines of American law relating to the utlization of waters--the riparian and prior appropriation doctrines--are examined in this work. Chapter 1 treats Georgia's existing water laws, particularly the riparian doctrine as declared by Georgia statutes and judicial decisions. The various legal classes of waters and the applicable legislation are also noted. In addition the important Georgia cases are summarized and categorized as to facts and rationale. Chapter 11 is devoted to the doctrine of prior appropriation. In this chapter the history of the prior appropriation doctrine is traced, and the doctrine's important features are described. The constitutional problems confronting lawmakers in the enactment of water rights legislation are discussed in Chapter 111. Emphasis is placed upon constitutional problems in converting from a riparian rights system to a system of prior appropriation. The advantages and disadvantages of the two water law doctrines are analyzed in the summary and conclusion, along with some broad deductions drawn from the study. The primary advantage of the riparian doctrine is stated to be flexibility, permitting facile adjustment to changing circumstances; however, the same flexibility creates uncertainty as to the extent of the riparian right. (Hart-Florida)
W71-05820

COMMUNITY WATER SUPPLY IN DEVELOPING COUNTRIES: A QUARTER-CENTURY OF UNITED STATES ASSISTANCE,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 03B.
W71-05821

ARKANSAS GAME AND FISH COMM'N V STORTHZ (OWNERSHIP OF FISH IN PRIVATE LAKES).

181 Ark 1089, 29 SW2d 294-297 (1930).

Descriptors: *Arkansas, *Fishing, *Fish, *Nonnavigable waters, Lakes, Ponds, Surface waters, Ownership of beds, Riparian rights, Beds under water, Legal aspects, Judicial decisions, Water law, State governments, Damages, Land tenure, Administrative agencies, Contracts.
Identifiers: *Ownership of lakes.

Plaintiff landowner sought the cancellation of contracts given by defendant, the Arkansas Game and Fish Commission, for the exclusive right to trap and seine fish in two lakes on land owned by the plaintiff. Plaintiff also sought a judgment for the value of the fish taken an a restraining order against further fishing. The lakes were not connected with any navigable stream. The trial court dismissed the complaint in part but awarded damages. Plaintiff appealed, alleging that the lakes were private lakes, and defendant contended that the state owned the fish. The Supreme Court of Arkansas affirmed the award of damages and reversed the trial decision dismissing part of the complaint. Where a lake or pond is entirely within the land of one owner and there is no means of passage by which the fish can migrate to the waters of other owners, the landowner possesses the fish and fishing rights. (Robinson-Florida)
W71-05822

UNITED STATES V 687.30 ACRES OF LAND (RIGHT OF UNITED STATES TO CONDEMN LAND FOR RIVER IMPROVEMENT PROJECT).

319 F Supp 128-134 (D Neb 1970).

Descriptors: *Eminent domain, *United States, *Treaties, *Indian reservations, Federal government, Condemnation, Land, Land tenure, Administrative agencies, Administrative decisions, Nebraska, Missouri River, Multiple-purpose projects, Projects, Judicial decisions, Legal aspects, River basins, Water utilization, Irrigation, Navigation.

Plaintiff United States sought to condemn land i Nebraska belonging to defendant Indian tribe. Th project was part of a comprehensive plan adopte by Congress to achieve maximum utilization of th water resources within the Missouri River Basi The Secretary of the Army made the decision t condemn the land pursuant to authority delegate by Congress in an 1888 act. Defendant contende that it owned the land by virtue of a treaty with th United States and that, while Congress coul abrogate the treaty and condemn the land, it coul only do so by specific legislation. Defendant als contended that the taking constituted deprivatio of property without due process of law under th fifth amendment. The federal district court grante plaintiff's motion for summary judgment. Congre was not required to enact specific legislation t condemn land owned by Indians. The decision t condemn the land was a reasonable exercise o authority delegated by Congress to the Secretary Defendant's due process argument was witho merit. (Duss-Florida)
W71-05823

WISCONSIN V ILLINOIS (STATE OBLIGATION TO ASSIST CITY IN COMPLYING WIT COURT DECREE).
289 US 395, 710, 53 Sup Ct 671-678 (1933).

Descriptors: *Illinois, *Diversion, *Lake Michiga *Cities, Wisconsin, Michigan, New York, Relativ rights, Diversion dams, Diversion losses, Lake State governments, Sewage, Sewage treatmen Canals, Legal aspects, Judicial decisions, Gover ments, Federal government, United States.
Identifiers: *Chicago.

Plaintiff states of Wisconsin, Michigan and Ne York brought action to compel defendant Illino to assist Chicago in construction of sewage trea ment facilities to reduce diversion of water fro Lake Michigan. The municipality was financiall unable to complete the project. Defendant co tended that Chicago was the prime defendant in th original decree which had ordered Chicago to co struct a treatment plant to eliminate the diversio The United States Supreme Court observed th Chicago was an instrumentality of defendant, an hence defendant was responsible. Defendant als contended that congressional legislation permittin diversion from Lake Michigan conflicted with th decree, but the Court held that the statute did n affect the decree, nor did possible restoration the lake level through treaty and other legislatio Defendant next asserted that, since under the ter of the decree diversion was to be reduced gradual over a period of years, the decree had not yet bee violated and that defendant was not bound to exe cise its police power to reduce the diversion. Ho ever, the court observed that jurisdiction had bee retained. Defendant was ordered to furnish fun to enable Chicago to comply with the decre (Hart-Florida)
W71-05824

UNITED STATES EX REL GREATHOUSE DERN (REFUSAL OF UNITED STATES T GRANT WHARF PERMIT).

289 US 352, 53 Sup Ct 614-617 (1933).

Descriptors: *United States, *Permits, *Navigab rivers, *Condemnation, Administrative decision Docks, Rivers, Federal government, Administra tive agencies, Highways, Roads, Riparian lan Riparian rights, Accretion (Legal aspects Eminent domain, Condemnation value, Bed Ownership of beds, Navigation, Adjudicatio procedure, Judicial decisions, Legal aspects.

On relation of a landowner, plaintiff United State brought mandamus against defendant Secretary War to compel him to issue a permit to construct wharf in a navigable river. Defendant had n refused to grant the permit because the wha would obstruct navigation, but because the prope ty was to be condemned for use as part of highway. Plaintiff contended that his riparian righ

luded the right to erect wharves which did not struct navigation. Defendant asserted that mannus would not lie because neither the duty of dedant nor the right of plaintiff was clear. The ited States Supreme Court, rejecting the contenns of both parties, held that mandamus would be granted to require an idle act which would mately increase the government's condemnan cost. (Hart-Florida)
1-05825

ITED STATES V RIVER ROUGE IMPROVENT CO (REVIEW OF CONDEMNATION 'ARD OF FEDERAL NAVIGATION PROCT).
US 411, 46 Sup Ct 144-148 (1926).

criptors: *Michigan, *Riparian rights, *Conination value, *Rivers and Harbors Act, inent domain, Condemnation, Riparian land, igation, Navigable rivers, Docks, Piers, Comsation, Payment, Adjudication procedure, ted States, Federal government, Legal aspects, icial decisions.

ntiff United States appealed from a condemna- award to defendant riparian landowner. The ers and Harbors Act permitted the value of spe- benefits accruing to remaining portions of the demned property, exceeding ordinary benefits he community, to be deducted from the conination award. However, the jury was instructed to deduct appreciated property value as a spebenefit and that subjection of riparian property he congressional power to improve navigation nt prevent special benefit from accruing. Plaincontended that these instructions were erroneThe United States Supreme Court noted that: riparian rights included access to the navigable am and the right to construct landings and s; (2) riparian rights in Michigan are detered by common law; (3) riparian rights are subnate to the public right of navigation; and (4) gress cannot impair riparian rights except to ove navigation. Determining that the inssed value of the remaining land was a special efit, and that the jury instruction on the consional power to impair riparian rights was imer, the Court held that the lower court had mitted reversible error. A new trial was ted. (Hart-Florida)
-05826

V YORK POWER AND LIGHT CORP V TE (GRANTS OF RIGHTS IN NAVIGABLE EAMS).
App Div 338, 245 NYS 44-65 (1930).

criptors: *New York, *Public rights, nsites, *Navigable rivers, State governments, slation, Governments, Riparian rights, Relative s, Legal aspects, Judicial decisions, Electric er, Dams, Canals, Flow, Rivers, Navigable rs, Navigation, Streams, Contracts, Perance, Adjudication procedure, Projects, Sites, rsion.

egislative act plaintiff power company was ted the right to construct a dam in a stream. tiff failed to exercise this rights, and defendant , to divert water into a canal, constructed a on the site granted for plaintiff's dam. Plaintiff ended that defendant was infringing the rights ed to it by the legislature and sought damages he value of those rights. The Supreme Court of York affirmed a judgment for defendant. A may unconditionally convey valid title in the of a navigable stream only for consideration nly in aid of navigation or public interests. A f rights or a grant of rights not in aid of naviga- is conditional and subject to the state's mount right to improve navigable streams. eover, a stream to be navigable need not be gable throughout its entire length. The state the beds of navigable streams in trust for the le, and such beds may not be conveyed against ublic interest. In the instant case: (1) there was no consideration; (2) the stream was navigable; (3) the grant to plaintiff was not in aid of the public interest; and (4) the state's construction of a dam improved navigation. (Dye-Florida)
W71-05827

LOUISIANA AND MISSISSIPPI RR TRANSFER CO V LONG (COMPENSATION FOR USE OF LANDOWNER'S RIVER BANKS FOR MOORING OF BOATS).
131 So 84-89 (Miss 1930).

Descriptors: *Mississippi, *Rent, *Banks, *Boats, Relative rights, Mississippi River, Louisiana, Remedies, Navigable waters, Navigable rivers, Railroads, Compensation, Reasonable use, Beds, Overflow, High water mark, Low water mark, Low water mark, Land tenure, Legislation, Legal aspects, Judcial decisions, Adjudication procedure, Watercourses (Legal).
Identifiers: *Conflicts of law, Mooring.

Plaintiff landowner sought in the Mississippi courts to recover the rental value of property used and occupied by defendant railroads. Defendants for many years operated railroad transfer boats across the Mississippi River and moored them upon plaintiff's property on the Louisiana side. Defendant contended there was no liability to plaintiff as Louisiana law controlled. Under such law rivers are highways, are open to the public, and everyone has the right to moor vessels on river banks. Defendants also contended that even if there was liability, the three-year Louisiana limitation on recovery should apply rather than the six-year Mississippi limitation, thereby reducing recovery. The trial court found for plaintiff and instructed the jury to assess damages at the claimed monthly rate for six years. The Supreme Court of Mississippi affirmed in part and reversed in part, holding that Louisiana law applied as to ownership of banks and, although the use of banks on navigable rivers is public, the owner of banks is entitled to compensation for mooring. As to the remedy, the Mississippi recovery limitation applied since it was the forum where the action was brought. (Duss-Florida)
W71-05828

FLOYD COUNTY V FINCHER (RECOVERY OF DAMAGES FOR PERMANENT INJURY FROM NUISANCE).

150 SE 577-579 (Ga 1929).

Descriptors: *Georgia, *Adjudication procedure, *Damages, *Highway effects, Local governments, Flooding, Legal aspects, Judicial decisions, Highways, Drainage water, Remedies, Drainage, Surface drainage, Ditches, Drainage effects, Land, Crops, Surface waters, Real property.

Plaintiff sought damages and an injunction for injury to his property resulting from construction of a public road by defendant county. Plaintiff alleged that the road caused drainage water to flow across his land, destroying his crops and extinguishing the value of his land for rental purposes. Plaintiff did not allege a decrease in value to his land resulting from defendant's actions. Defendant contended that plaintiff posed no cause for equitable relief and alleged no proper measure of damages. The Supreme Court of Georgia reversed the decision of a lower court overruling defendant's demurrer. Plaintiff was not entitled to an injunction against a continuing nuisance because roadbuilding is an important public function requiring an abuse of discretion for equitable relief. Plaintiff was left to an action for damages for the taking of his property, amounting to the difference in value before and after defendant's actions. However, no measure of damages was alleged for permanent injury to plaintiff's land. Thus plaintiff stated no cause of action. (Dye-Florida)
W71-05829

BRACKETT V BELLOWS FALLS HYDROELECTRIC CORP (PERSONAL INJURIES DUE TO TRESPASS OF WATER FLOW).
175 A 822-823 (NH 1934).

Descriptors: *New Hampshire, *Damages, *Floods, *Water levels, Legal aspects, Judicial decisions, Adjudication procedure, Flow, Watercourses (Legal), Dams, Rivers, Ponds, Hydroelectric plants, Land tenure, Water level fluctuations.

Plaintiff farm owner sued defendant hydroelectric corporation for damages. Defendant had raised the level of its dam so that the level of water at plaintiff's farm was also raised. As a consequence, a pool formed on plaintiff's field. No permission to so overflow was ever granted defendant, nor had defendant ever acquired flowage rights. Muskrats invaded the pool and built nests. While plaintiff was operating a horse-drawn mowing machine, one of the horses stepped in a muskrat hole and plaintiff was injured. Defendant contended that it was not liable for damages which were not probable nor should have been anticipated by it. The jury at the trial returned a verdict for plaintiff, and the Supreme Court of New Hampshire affirmed. Whether the flowing of plaintiff's farm was the cause of plaintiff's injury was properly a question for the jury. (Duss-Florida)
W71-05830

STATE V GUTHRIE (VALIDITY OF STATE PATENT TO ISLAND IN NAVIGABLE RIVER).
156 SW2d 210-215 (Ark 1941).

Descriptors: *Arkansas, *Islands, *Land tenure, *State governments, Navigable rivers, Real property, Proprietary power, High water mark, Rents, Navigable waters, Legal aspects, Judicial decisions, Administrative decisions, Adjudication procedure, Coal mines, Mining, Taxes.
Identifiers: Patents (Land).

Plaintiff state sued to set aside a deed, to recover an island held by defendant landowner, and to obtain an accounting for coal mined on the island. Plaintiff contended that the state land Commissioner had no authority to sell the island unless it was suitable for agriculture and above the mean high water mark of the river. Defendant contended that the land was both suitable for agriculture and above the high water mark. Reversing a judgment sustaining defendant's demurrer, the Supreme Court of Arkansas noted that although the land commissioner is presumed to have properly performed his duty under the law, plaintiff's contentions should have been accepted as true on demurrer since that presumption is not conclusive. The court also noted that equity would not allow plaintiff to recover the property or the profits therefrom without offering and paying a refund of defendant's purchase price, past taxes paid, and the cost of improvements. (Liptak-Florida)
W71-05831

STATE V QUATTROPANI (VALIDITY OF NO-BOATING ORDER TO PROTECT MUNICIPAL WATER SUPPLY).

133 A 352-355 (Vt 1926).

Descriptors: *Vermont, *Municipal water, *Boating regulations, *Water supply, Water quality control, Lakes, Ponds, Great ponds, Reasonable use, Riparian rights, Cities, Administrative agencies, Administrative decisions, Public rights, Public health, Potable water, Water quality, Water pollution, Water pollution sources, Water pollution control, Legislation, Boating, Regulation, Legal aspects, Adjudication procedure.

Respondent riparian owner was convicted of violating an order of the state board of health prohibiting boating on a pond which was used as a municipal water supply. Respondent contended that the order was void for lack of notice and as a taking of his riparian rights without compensation. The court af-

firmed the conviction and held that the only notice required was that of legislative publication, the board's order having the same effect. The court also noted that the order protecting the purity of the water supply was a reasonable exercise of state's police power and constituted a regulation, not a taking, of respondent's riparian rights and privileges. (Liptak-Florida)
W71-05832

NIES V BULKLEY (LIABILITY FOR BARGE COLLISION WITH SUBMERGED PILE).
104 Conn 382, 132 A 873-875 (1926).

Descriptors: *Connecticut, *Navigable rivers, *Boats, *Timber piles, Navigable waters, Rivers, Bridges, Bridge construction, Ships, Navigation, Piles (Foundations), Damages, Accidents, Engineering, Engineering structures, Transportation, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff barge owner brought action against defendant bridge and highway commission to recover for damage to his barge caused when it ran into a submerged pile in a navigable river. Plaintiff contended that defendant had driven several temporary piles at the spot 14 years earlier in connection with the construction of a bridge and that the pile by which his barge was damaged was left in the river bed when the others were removed. Defendant contended that all their piles were 6 to 12 feet above the water and had been removed by the contractor under the supervision of the War Department engineer. The Supreme Court of Errors noted that whether the river was navigable at that spot and whether the War Department engineer properly performed his duties were questions for the jury, and that the trial judge improperly directed a verdict for defendant. However, the court affirmed the judgment for defendant and held that there was no evidence from which the jury could have found that the pile was one of the cluster driven by defendant at the spot 14 years prior to the accident. (Liptak-Florida)
W71-05833

STATE V ERWIN (TITLE TO ERODED LAND ON BED OF LAKE).
173 La 507, 138 So 84-92 (1931).

Descriptors: *Louisiana, *Ownership of beds, *Erosion, *Lakes, Navigable waters, High water mark, Accretion (Legal aspects), Shores, Beds, Boundaries (Property), Boundary disputes, Channels, Tides, Currents (Water), Rivers, Streams, Banks, Land tenure, Saline water, Fresh water, Legal aspects, Judicial decisions, Beds under water.

Plaintiff state of Louisiana brought suit to determine ownership of land which had by erosion become part of a lake. Plaintiff argued that the laws of accretion and dereliction applied and that defendants lost title to the land eroded away by the waves of the lake. Defendants contended that their title was good to the meander line established when Louisiana was admitted to the Union. The Supreme Court of Louisiana affirmed a judgment for defendants. The laws of accretion and dereliction do not apply to lakes. The lake in question was not merely a section of a navigable river. Thus, the state did not acquire title to the eroded land. One judge dissented on the grounds that the laws of accretion and dereliction do apply to lakes. On rehearing the court rejected the argument that the lake was an arm of the sea, although the lake was affected by the tides and was occasionally salty. If the lake had been found to have been an arm of the sea, adjoining lands which became part of the lake bed by erosion would belong to the public. (Duss-Florida)
W71-05834

KATZENBACH V ARMSTRONG CORK CO (CONSTRUCTION OF STATUTORY GRANT OF FILL RIGHTS IN NAVIGABLE RIVER).
132 A 324-325 (NJ Ch 1926).

Descriptors: *New Jersey, *River beds, *Landfills, *Legislation, Navigable rivers, Navigable waters, Delaware River, Tidal waters, Ownership of beds, Riparian rights, Riparian land, Riparian waters, Boundaries (Property), Boundary disputes, Reclamation, Land forming, Land development, Usufructuary right, Land tenure, Public lands, State governments, Cities, Legal aspects, Water law, Judicial decisions.

Plaintiff state sued to restrain defendant corporation from reclaiming and improving certain riparian and submerged land on the Delaware River. Plaintiff contended that defendant had no title to the land and would have to lease or purchase the land from the state. Defendant claimed title and the right to fill under a statute granting defendant's predecessor the right to fill and occupy any land fronting or adjoining its upland. The Court of Chancery of New Jersey noted that the special act granting fill privileges to defendant's predecessor should be strictly construed and considered revoked as to any land not already reclaimed or otherwise improved by the date of enactment of a later general act prohibiting reclamation of submerged tidewater land without the state's permission. Therefore, the court decreed in favor of plaintiff as to land not already reclaimed or improved at the passage of the subsequent general act. (Liptak-Florida)
W71-05835

6G. Ecologic Impact of Water Development

AN ENVIRONMENTAL SURVEY OF THE LOWER CLEARWATER RIVER,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 04A.
W71-05336

TERRESTRIAL DESERT ARTHROPODS: FAUNA AND ECOLOGY,
Tennessee Univ., Knoxville. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 02I.
W71-05478

ECOLOGIC AND ENVIRONMENTAL CONSIDERATIONS IN WATER RESOURCES MANAGEMENT,
Office of Water Resources Research, Washington, D.C.
Daniel L. Leedy.
In: Report on 5th Annual Water Resources Research Conference, Sponsored by the Office of Water Resources Research, Dept. of the Interior, Washington, DC, Feb 3-4, 1970, p 23-26.

Descriptors: *Environmental, *Ecology, Water policy, Planning, Coordination, Resource development, Future planning.
Identifiers: *Environmental problems, *Environmental quality, Water supply systems.

One of the significant trends in water and related resources fields in recent years has been the increased public awareness of environmental pollution. There is a definite need for scientists and ecologists to combine talents and direct their thinking to improving the environment. Expanding population adds other serious problems meeting increased water and recreational demands. In the future, there is an urgent need for more applied ecological research. (Wray-Chicago)
W71-05785

07. RESOURCES DATA

7A. Network Design

ROLE OF INFILTRATION IN NONLINE WATERSHED ANALYSIS PROCESSES,
California Univ., Davis. Dept. of Water Scie and Engineering.
For primary bibliographic entry see Field 02A.
W71-05354

A PROPOSED STREAMFLOW DATA PR GRAM FOR MISSOURI,
Geological Survey, Rolla, Mo.
John Skelton, and Anthony Homyk.
Geological Survey Open-file report, 1970. 44 p fig, 3 plate, 14 tab, 10 ref, append.

Descriptors: *Streamflow, *Hydrologic data, *P ject planning, *Missouri, Evaluation, Data col tions, Regression analysis, Water resour development, River basins, Watershed mana ment, Flow characteristics, Channel morpholo Precipitation (Atmospheric), Topography, Vege tion, Gaging stations, Stream gages, Drainage, properties.
Identifiers: *Streamflow data evaluation (Miss ri).

The streamflow data program in Missouri is ev ated in order to design a network that will most e ciently produce the types of information needed development of surface water resources in state. The evaluation study has defined a prog of streamflow data collection and analysis for c rent purposes, planning and design, monitorin long-term trends, and definition of the stream vironment. A regression analysis that used stre flow data from 225 continuous and partial-rec gaging stations located in Missouri and adjoi states showed that, for ungaged sites on m streams with drainage areas greater than 50 squ miles, the following characteristics can be e mated within prescribed accuracy limits b regression equation: (1) mean flows, stand deviations of the annual means, low-order flo and flood volumes in the Plains region, (2) s dard deviations of the annual means, high-or floods, and flood volumes in the Plateaus reg and (3) high-order floods and flood volumes in Lowlands. A recommendation is made that 18 c tinuous-record stations be discontinued and tha be established. This will result in more substan streamflow data plus significant economics in work operation. (Woodard-USGS)
W71-05369

A PROPOSED STREAMFLOW-DATA P GRAM FOR IDAHO,
Geological Survey, Boise, Idaho.
C. A. Thomas, and W. A. Harenberg.
Geological Survey Open-file report, October 19 71 p, 2 fig, 12 tab, 12 ref, append.

Descriptors: *Streamflow, *Network design, *D collections, *Idaho, Planning, Stream ga Synoptic analysis, Assessments, Floods, Low f Stage-discharge relations, Surface-groundw relationships, Instrumentation.

A streamflow information system is proposed, sisting of both data collection and analyses to ciently provide the knowledge required for (1) rent water use and management, (2) planning design, (3) determination of long-term trends, (4) assessment of stream environment. proposal is the result of a study in which the b steps were definition of long-term program g examination and evaluation of available dat determine which goals have been achieved, consideration of alternate programs and techni for meeting the remaining goals. Systematic co tion of streamflow data began in 1889 with ga stations on Bear River near Preston, Snake Riv Idaho Falls, and Big Wood River at Hailey. D

s for flood control, irrigation, hydroelectric
er, fish studies, recreational appraisals, naviga-
and waste disposal have resulted in operation
aging stations at many places for various
ods. Program enlargements occurred in 1910,
World War I, during the drought of the
's, in 1943 for needs of a tri-state compact,
during the early 1960's. In 1969 the Geological
ey streamflow data program was publishing
records for streams, reservoirs, and major
sions at 252 continuous record sites and an-
flood-peak data at 80 sites. Areas of inadequa-
include data to define 100-yr floods, low-flow
all streams, seepage, return flows, and regula-
(Lang-USGS)
-05373

**ROPOSED STREAMFLOW DATA PRO-
M FOR MISSISSIPPI,**
ogical Survey, Jackson, Miss.
rimary bibliographic entry see Field 02E.
-05445

**ITORING CONCEPTS AND REQUIRE-
TS IN COASTAL WASTES MANAGE-
T,**
nal Academy of Engineering, Washington,
and National Academy of Sciences, Washing-
D.C.
rimary bibliographic entry see Field 05A.
-05540

Data Acquisition

**D TESTING OF THE IAEA PORTABLE
OISOTOPE SEDIMENT-CONCENTRA-
GAUGE,**
try of Works, Wellington (New Zealand).
r and Soil Div.
Morrissey.
Zealand Ministry of Works, Water and Soil
on Miscellaneous Hydrological Publication
1970. 17 p, 6 fig, 6 ref, 2 append. IAEA Con-
553/TC.

iptors: *Sediment discharge, *Suspended
*Analytical techniques, *Evaluation,
ioisotopes, Methodology, Testing, Test
dures, Sediment transport, Surface waters,
ns, Flow rates, Streamflow, Instrumentation,
te sensing, Sediment yield, On-site investiga-

fiers: *Radioisotope sediment gage, *New
nd.

AEA (International Atomic Energy Agency)
ent-concentration gage is described. The
ods of carrying out the field calibrations by
s of a conventional sampler, the DH-48, are
arized, and the calibration curve is shown.
naximum sediment concentrations encoun-
under natural conditions did not exceed
ppm, but sediment concentrations exceeding
0 ppm were artificially generated in the field.
ed testing for the effect of temperature
e on the gage response showed that tempera-
as highly significant. Marked response to sea
appeared sufficient to preclude use of
sotope methods in brackish waters. It is
mended that the inconsistencies of the IAEA
when measuring low sediment concentra-
be studied with the object of developing a
sensitive radioisotope sensing system. The
nergy X-radiation from the cadmium-109
represents the end result of considerable
ch into the problem of lack of sensitivity of
sotopes in low sediment concentrations. The
ne advantage of radioisotope sediment mea-
ent is the elimination of the time and labor
ems associated with the conventional sam-
methods, and this advantage justifies the ex-
directed towards the development of greater
ility and sensitivity in radioisotope sediment-
ntration gages. (Woodard-USGS)
05352

SNOW SURVEY TECHNIQUES IN THE WAITAKI CATCHMENT, SOUTH CANTERBURY,
Ministry of Works, Timaru (New Zealand).
For primary bibliographic entry see Field 02C.
W71-05355

STREAM DISCHARGE ESTIMATION,
Forest and Range Experiment Station, Rangiora (Newland).
F. A. Johnson.
Journal of Hydrology (New Zealand), Vol 9, No 1, p 22-28, 1970. 7 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Stream gages, *Discharge measurement, *Tracers, Electrical conductance, *Mixing, Discharge (Water), Streamflow, Electrolytes.
Identifiers: *Stream discharge estimation.

An electrically measured tracer method that minimizes the amount of field and laboratory work when measuring the three discharges at the junction of a main stream and a tributary is described. A comparison between discharges calculated from actual measurements and estimated from an electrical conductivity analysis is made. The dilution gaging technique to measure discharges upstream and downstream from the junction of a main stream and its tributary usually involves two discharge measurements and one estimation. The amount of field and laboratory work involved can be considerably reduced by making only one discharge measurement and using three electrical conductivity measurements to estimate the remaining two discharges. The technique is based on the injection of sodium dichromate solution at a constant rate, and the measurement of the subsequent dilution. (Knapp-USGS)
W71-05361

A HEATED ALPINE PRECIPITATION GAUGE,
Forest and Range Experiment Station, Rangiora (New Zealand).
C. L. Batcheler.
Journal of Hydrology (New Zealand), Vol 9, No 1, p 36-42, 1970. 7 p, 4 fig, 4 ref.

Descriptors: *Precipitation gages, *Snowfall, *Rain gages, Gaging stations, Data collections, Meteorological data, Instrumentation, Equipment, Precipitation (Atmospheric), Runoff forecasting.
Identifiers: *New Zealand.

A gage for measuring total precipitation at an alpine station, where most winter precipitation is snow, is described. The heating system in the gage employs an electro-mechanical device to control ignition and damping of a kerosene burner. Precipitation totaling 131 in., of which 37% was snow, was estimated for 1965 at an altitude of 4,700 ft. The recorded catch appears to be reasonably reliable. (Knapp-USGS)
W71-05363

POLLUTION, OCEANOLOGY AND LIMNOLOGY IN THE GREAT LAKES,
Northeastern Illinois State Coll., Chicago. Dept. of Geography.
For primary bibliographic entry see Field 02H.
W71-05398

DETERMINATION OF ORGANIC- AND CARBONATE-CARBON IN FRESHWATER LAKE SEDIMENTS BY A MICROCOMBUSTION PROCEDURE,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-05399

OCEAN OUTFALL DISPERSION,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 05A.
W71-05521

INSTRUMENT TO MEASURE WEAK SEA CURRENTS,
Ente Nazionale per l'Energia Eletrrica. Cellole (Italy). Laboratorio Ricerche Ambientali Garigliano.
For primary bibliographic entry see Field 05B.
W71-05522

DETECTION OF OIL SLICK POLLUTION ON WATER SURFACES WITH MICROWAVE RADIOMETER SYSTEMS,
Microwave Sensor Systems, Inc., Downey, Calif.; and California Univ., Santa Barbara.
For primary bibliographic entry see Field 05A.
W71-05533

OPTICAL (INFRARED AND ULTRAVIOLET-VISUAL) REMOTE SENSING OF POLLUTION OF WATER BODIES,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 05A.
W71-05538

MEASURING SOIL MATRIC POTENTIAL IN SITU BY SENSING HEAT DISSIPATION WITHIN A POROUS BODY: 1. THEORY AND SENSOR CONSTRUCTION,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 02G.
W71-05608

WATER-CO SUB 2 EXCHANGE SET-UP FOR THE ROUTINE 18-OXYGEN ASSAY OF NATURAL WATERS,
Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.
For primary bibliographic entry see Field 05A.
W71-05640

A ROTATING SAMPLING ARM--AN AID TO AUTOMATIC ANALYSIS OR SAMPLING,
Upper Tame Main Drainage Authority, Birmingham (England).
For primary bibliographic entry see Field 05A.
W71-05652

MEASURING DIRECTIONAL VELOCITY IN WATER WAVES WITH AN ACOUSTIC FLOWMETER,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 08B.
W71-05656

TRACING SAND MOVEMENT IN THE LITTORAL ZONE: PROGRESS IN THE RADIOISOTOPIC SAND TRACER (RIST) STUDY - JULY 1968-FEBRUARY 1969,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02J.
W71-05657

MECHANICAL BEHAVIOR OF CONCERETE EXAMINED BY ULTRASONIC MEASUREMENTS,
Illinois Univ., Chicago.
For primary bibliographic entry see Field 08F.
W71-05723

COMPLETE ADJUSTMENT METHOD FOR ANALYZING ARCH DAMS,
COBA-CONSULPRESA, Lisbon (Portugal).
For primary bibliographic entry see Field 08A.
W71-05733

INFORMATION FOR DECISIONS IN ENVIRONMENTAL POLICY,
Library of Congress, Washington, D. C. Environmental Policy Div.
Richard A. Carpenter.
Science Vol 168, June 12, 1970, p 1316-1322. 1 tab, 3 ref.

Descriptors: *Environment, Political constraints, Ecology, Legislation, Federal government, *Decision-making.
Identifiers: *Environmental policy, Legislative Reference Service, Public policy.

The National Environment Policy Act of 1969 promises to be landmark legislation in stimulating ecological research. Rising public concern with better use of resources requires a historic and wrenching turn for both business and political processes. Three approaches to environmental quality and productivity are currently identifiable and important. The traditional approach is marketplace economics: determining costs of all aspects of a policy problem, in which a major difficulty is the quantification of long-term interests when economic theory discounts the future value of money. A second well-established viewpoint is that of human health. The powerful appeal of protecting health is useful in motivating social actions that are otherwise uneconomic. The third approach is that of ecology, for which it is difficult to quantify values. In order to legislate policy of protect and enhance the environment, the legislators must have technical information on which to base decisions. This information flows from all levels of society via diverse mechanisms, i.e., personal advisory groups, committee hearings, executive agencies, lobbies, etc. The Legislative Reference Service serves as a center for information; the Environmental Policy Division handles the information relating to environment. An important aspect in assisting Congress is to keep objective, technological questions separated from the political context. Ecologists, now gaining prominance in the environmental field, have a tremendous opportunity to influence policy through their participation in public affairs. (Wray-Chicago)
W71-05771

7C. Evaluation, Processing and Publication

SUMMARY OF GROUNDWATER HYDROLOGICAL DATA IN MICHIGAN FOR 1969,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02F.
W71-05351

HYDROGEOLOGIC DATA FOR THE UPPER HOUSATONIC RIVER BASIN, CONNECTICUT,
Geological Survey, Hartford, Conn.
Robert L. Melvin.
Geological Survey Open-file report, 1970. 33 p, 2 fig, 1 plate, 7 tab, 11 ref.

Descriptors: *Data collections, *Hydrologic data, *Connecticut, Water wells, Springs, Groundwater, Water levels, Aquifers, Glacial drift, Hydrogeology, Sediment, Sampling, Water resources, Water resources development.
Identifiers: *Aquifer tests, *Pumping tests, *Housatonic River Basin (Conn).

The upper Housatonic River basin covers an area of about 700 square miles in western Connecticut. Records of 284 wells and 5 springs, logs of 322 wells and test holes, mechanical analyses of 58 sediment samples of stratified drift and records of 3 pumping tests are contained in this report. The locations of all sites at which hydrogeologic data were collected are shown. The information is to be used with the companion interpretive report and should facilitate the development of water resources at specific localities. (Knapp-USGS)
W71-05357

A PROPOSED STREAMFLOW DATA PROGRAM FOR CENTRAL NEW ENGLAND,
Geological Survey, Boston, Mass.
For primary bibliographic entry see Field 02E.
W71-05360

SURFACE WATER DATA - QUEBEC, WATER YEAR 1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Translation of Annuaire Hydrologique - Quebec by Quebec Dept. of Natural Resources, Water Survey of Canada. Canada Dept of Energy, Mines and Resources, Inland Waters Branch Data Report: Information Canada, Ottawa, 1970. 339 p.

Descriptors: *Surface waters, *Hydrologic data, *Gaging stations, *Networks, *Data collections, Streamflow, Rivers, Lakes, Reservoirs, Dams, Powerplants, River basins, Discharge measurements, Water levels.
Identifiers: *Canada, Quebec, Hydrometric network.

To fulfill data needs for most of the Province of Quebec, this publication presents a compilation of available discharge and water level data for rivers and lakes for the 1966 water year. The hydrometric network, divided into three categories, consists of 351 stations, 41 of which were added in 1966. Of the 193 regular streamflow stations 6 were seasonal. There were 68 stations equipped with punched tape recorders, 91 with stylus-type recorders and 34 with manual gages. Of the 88 water level stations, 11 are crest gages, 22 are equipped with automatic recorders and 52 have a manual gage. There are 70 stations at dams, 42 at reservoirs and 28 at powerplants. This publication contains recorded water levels and computed discharges grouped by hydrographic regions. Eight small scale maps show the drainage patterns and location of streamflow and water level stations with numbers keyed to the data tables. Following the data tables is a numerical index that lists the stations which are shown in color on the maps. The index gives the number and name of the stations and page number on which the data are given. An alphabetical index to the report is given last. (Lang-USGS)
W71-05375

MATHEMATICAL MODEL OF RECALCINATION OF LIME SLUDGE WITH FLUIDIZED BED REACTORS,
General American Transportation Corp., Niles, Ill.
For primary bibliographic entry see Field 05D.
W71-05387

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 10. THE GREAT BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-05446

REPRESENTATIVE BASINS OF NEW ZEALAND-1970.
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02A.
W71-05448

BRIEF DESCRIPTIONS OF AND EXAMPLES OF OUTPUT FROM COMPUTER PROGRAMS DEVELOPED FOR USE WITH WATER DATA IN KANSAS,
Kansas Geological Survey, Lawrence.
Brent H. Lowell, Charles O. Morgan, and Jesse M. McNellis.
Available from NTIS as PB-194 969, $3.00 in paper copy, $0.95 in microfiche. Special Distribution Publication No 48, 1970. 61 p, 41 fig, 17 ref.
Identifiers: *Water supplies, *Kansas, *Hydrology, Statistical data, *Data processing systems, Digital computers, Geologic survey, Computer program
Water wells, Mathematical logic, Coding, Erro
Punched cards, Subroutines, Sedimentatio
Chemical analysis, Quality control, Irrigati
systems, Ions, Statistical distributions, Fluid flo
*Computer graphics, Fortran 4 programming la
guage.

Programs written in FORTRAN IV language ha
been developed in the Kansas District of the U
Geological Survey to handle basic water data
use of the digital computer. The programs chec
tabulate, graph, map, and statistically analyze da
derived from hydrologic and geologic investig
tions.
W71-05462

**DIGITAL SIMULATION MODEL OF INO
GANIC WATER QUALITY OF TAHO
TRUCKEE SYSTEM, NEVADA-CALIFORNI
PROGRESS REPORT,**
Nevada Univ., Reno. Center for Water Resourc
Research.
For primary bibliographic entry see Field 05G.
W71-05469

**AN APPROACH TO ACQUISITION AND HA
DLING OF SERIAL ENVIRONMENTAL DATA**
Westinghouse Ocean Research Lab., San Dieg
Calif.
A. Kirst, Jr., and R. W. Onstenk.
1970 IEEE International Conference on Engine
ing in the Ocean Environment, Panama Ci
Florida, September 21-24, 1970, Digest of Tech
cal Papers, p 51-53.

Descriptors: *Wastes, *Management, *Enviro
mental gradient, *Coasts, *Instrumentation, *Da
collections, *Computers, *Monitoring, Cos
Design criteria, On-site tests.
Identifiers: California, Florida, Sensors.

Attention has recently been focused on manag
ment programs for coastal waste control.
thorough understanding of the environmen
parameters operating in the coastal zone led to t
acquisition of instrument systems to measure su
parameters, their spatial and temporal variatio
and their interrelationships. A procedure for t
design and integration of such systems and two e
amples are presented. (Ensign-PAI)
W71-05537

**FLOODS ON NAPA RIVER AT NAP
CALIFORNIA,**
Geological Survey, Washington, D.C.
J. T. Limerinos.
For sale by U.S. Geological Survey, Washingto
D.C. 20242 - price 75 cents. Geological Surv
Hydrologic Investigations Atlas HA-348, 1 she
1970. Text, 3 fig, 1 map, 2 photo, 1 tab, 6 ref.

Descriptors: *Floods, *Surface waters, *Strea
flow, *Flood plains, *California, Gaging statio
Runoff, Discharge measurement, Hydrologic da
Flow measurement, Flow rates, Watershe
(Basins), Peak discharge, Stage-discharge re
tions, Flow profiles.
Identifiers: *Hydrologic Atlas, *Napa River (Na
Calif), Flood frequency, Flood profiles.

This atlas summarizes the results of an investigati
of the floodflow characteristics of the Napa Riv
in the vicinity of Napa, Calif. The approxima
areas inundated during the floods of February 2
1940, and December 22, 1955, are shown on t
map to record past floods and to aid in estimati
future flood risk. The drainage area upstream fro
the Geological Survey stream-gaging station Na
River near Napa, near the north limit of the floo
inundation map, is about two square miles. T
principal tributaries--Conn, Dry, Milliken, a
Redwood Creeks--enter the Napa River in the l
mile reach upstream from Napa. Within the stu
area, Soda, Tulucay, and Milliken Creeks en
from the east and Napa Creek enters from the we

er illustrations and tables show major floods, d discharges, flood frequencies, flood profiles, aerial views of flooding in the Napa area. odard-USGS)
-05559

COMPUTER SIMULATION MODEL OF IMENTATION IN A SALT WEDGE ESTUA-

field Univ. (England). Dept. of Geology.
primary bibliographic entry see Field 02L.
-05586

ENDING THE RECORD ON THE TEME,
ingham Univ. (England). Dept. of Civil En-ering.
Hamlin, and N. T. Kottegoda.
nal of Hydrology, Vol 12, No 2, p 100-116, ary 1971. 17 p, 7 fig, 5 tab, 11 ref.

riptors: *Data collections, *Synthetic hydrolo-Streamflow forecasting, *Correlation analysis, lation analysis, Variability, Water yield, Ru-forecasting, Probability.
ifiers: *Teme River (England).

ne length of record of the Teme River, En-d, is insufficient for the prediction of the acteristics of future water supplies by means of generation, a comparison was made to the 47 old record of the Severn at Bewdley. High cor-on was found between the flows at the two sta-. This coefficient together with the serial cor-on coefficients, the means, variances, and ability distributions at each site were used in a iate model for generating synthetic river flow ences, the relevance of which were checked by tical tests. The main purpose of the model, to rate critical values and sequences having a er range than those found in the historical , was achieved. Reservoir storages for varying n periods, probabilities of non-exceedance, draft rates are obtained through a modified method. (Knapp-USGS)
-05589

ROPOSED TECHNIQUE FOR IDENTIFICA-N OF UNCONFINED AQUIFER PARAME-S,
ornia Univ., Los Angeles.
primary bibliographic entry see Field 02F.
-05591

LOT II - COMPUTER PROGRAM FOR A PROCESSING AND GRAPHICAL DIS-Y FOR RADIOISOTOPIC SAND TRACER DY,
Coastal Engineering Research Center, ington, D.C.
A. Turner.
C Miscellaneous Paper 3-70, May 70. 66 p, 10

riptors: *Computer programs, *Oceanog-, Continental shelf.
ifiers: *Dynamic oceanography, ioisotopic sand tracer, Hydrographic survey.

LOT II is a computer program for processing tion and navigation data from field surveys of isotopic sand tracer (RIST) study, but is ap-ble to any survey type operation on the hore Continental Shelf. Collected data are hed onto paper tape by the data collection puter on the research vessel. The data are later ferred to magnetic tape which provides the for the RAPLOT II Program. Program con-arameters are on punched cards. The naviga-data, which consists of ranges to two shore-l radar beacons, are first edited for spurious and then converted to rectangular coor-es (in this case the California Lambert Coor-e System). Radiation data are converted to t rate as counts per second. Background count s computed and subtracted from the observed count rate, and any radiation counts that are significantly above the background count rate are corrected for time of decay since the isotope was injected. Output from the program is in three forms - printed output, graphical output, and magnetic tape record. The processed data are transferred to magnetic tape and made available for further processing, such as the generation of contour maps. (CERC)
W71-05658

AN EXPERIMENT IN FINITE-DIFFERENCE WATERSHED MODELING,
Montana Univ., Boziman. Joint Water Resources Research Center.
For primary bibliographic entry see Field 02A.
W71-05701

SIMULATION VIA TIME-PARTITIONED LINEAR PROGRAMMING: A GROUND AND SURFACE WATER ALLOCATION MODEL FOR THE GALLATIN VALLEY OF MONTANA,
Montana State Univ., Bozeman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 02A.
W71-05716

08. ENGINEERING WORKS

8A. Structures

EXPERIMENTAL DUNES OF THE TEXAS COAST,
Army Coastal Engineering Research Center, Washington, D.C.
Bard O. Gage.
CERC Miscellaneous Paper 1-70, Jan 70. 33 p.

Descriptors: *Shore protection, *Dunes, Texas.
Identifiers: Barrier Islands, Snow fences, Beach grass, Junk car bodies.

Storms and increased habitation on barrier islands have reduced the height and width of dunes on the Texas Coast, thereby exposing it to the surges and waves produced by tropical storms in the Gulf of Mexico. This publication reports on experimental means of creating and stabilizing sand dunes to protect the coast. Four locations were selected; the SW end of Galveston Island, Packery Channel, Newport Pass on North Padre Island and Corpus Christi Pass. Low areas of the barrier islands were planted in various types of vegetative cover in an attempt to establish dunes without the aid of sand fences. Snow fencing was used to accumulate windblown sand and vegetative planting made to stabilize dunes. Junk car bodies were placed in line parallel to beaches and used instead of more conventional means to establish and stabilize dunes by trapping sand. Since snow fences are more effective and much cheaper junk cars are not recommended for building dunes.
W71-05660

BULLETIN AND SUMMARY OF RESEARCH PROGRESS, FISCAL YEARS 1967-69.
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 08B.
W71-05662

FOAM AGENTS AND FOAM DRILLING,
Jersey Production Research Co., Tulsa.
A. S. Murray, and J. E. Eckel.
Oil and Gas Journal February 20, 1961. Reprint, 4 p.

Descriptors: *Drilling fluids, Muds, *Drilling, Rotary drilling, Drilling equipment, Oil industry.
Identifiers: *Foam drilling, Air drilling, Mist drilling, Formation water, Foam injection, Cuttings.

Foam drilling is only one modification of air drilling, but its importance is growing. Successful foam drilling depends on an efficient foaming agent-one that has the properties needed to get the job done. This article deals with these requirements of a foaming agent, and other aspects of foam drilling. From experience, operators realize that air drilling in general has these advantages: (1) improved definition of stratigraphy and structure, (2) more and usually better well data, and (3) two to ten times the penetration rate and bit life. Dry formations are usually drilled with only air as a circulation medium. But when other conditions are present, the drilling fluid must be modified in these ways: (1) Foam drilling is used to penetrate competent water-bearing formations, (2) aeration drilling is used to penetrate less-competent formations that can be drilled with foam, and to lift large flows of formation water, and (3) chemicals are used to shut off flows from water-bearing formations. (Campbell-NWWA)
W71-05685

MUD KNOW-HOW HELPS EXPLORATION DRILLING,
National Lead Co., Houston, Tex., Baroid Div.
George R. Gray.
Mining in Canada, May and June, 1970. Reprint, 6 p.

Descriptors: *Drilling fluids, Muds, Drilling, Mining, Water wells, Rotary drilling, Core drilling.
Identifiers: *Drilling fluid function, Density, Flow properties, Gel development, Filtration properties, 'Bad ground', Wall-stuck rods, Lost circulation, Mud technology.

Modern drilling fluids technology is making substantial contributions to mineral exploration through reduction in time spent in coring, and improvement in core recovery. Both factors have become increasingly important in recent years because labor is a major item in the cost of exploratory drilling and increase in footage per shift is significant. The enormous capital investment needed to develop low-grade ores requires full information on the prospect; hence, the demand for complete core recovery. The mud should be used as a tool, not as a last resort when the situation otherwise appears hopeless. In the minds of many drillers 'mud' is associated only with 'trouble'. This attitude is not sensible. Mud should be employed as a device to avoid hole problems. Satisfactory performance of the drilling fluid depends on the conditions of use. The drill tools and the driller's skills, as well as the rocks drilled, significantly affect the success of the mud program. There is no more an all-purpose drilling fluid than there is an all-purpose diamond bit. Recognition of the limitations and capabilities of the personnel, the equipment, and the drilling fluid is essential to the effective planning of a coring program. (Campbell-NWWA)
W71-05686

ECONOMICS OF PERCUSSION VERSUS AIR ROTARY DRILLING,
Mission Mfg. Co., Houston, Tex.
Robert E. Bates, Jr.
World Oil, February 1, 1965. 9 p, 11 fig.

Descriptors: *Drilling, *Oil industry, Rotary drilling, Drilling equipment.
Identifiers: *Percussion rotary drilling, Air rotary drilling, Kinetic energy, Percussion bit life, Drilling rate.

Percussion drilling tools and technique are gaining acceptance and moving out of specialty application. The extremely rapid hammer blows - delivered with relatively light weight-on-bit-increase bit life, decrease drill collar wear and help control deviation while maintaining penetration rates. The technique is limited, however, to systems using circulating fluids which are compressible, such as air, natural gas and foam (mist). Percussion rotary drilling is the rotary technique in which the main source of energy for fracturing rock is obtained from a percussion machine connected

directly to the bit. The circulating system, drill string and hoisting system are unchanged from that used in the conventional air rotary method. Field performance results and cost-analysis nomographs determine when to consider using percussion drill. (Campbell-NWWA)
W71-05687

TELEVISION INSPECTION OF A GRAVEL PACK WELL,
Madison Water Utility, Wis.
For primary bibliographic entry see Field 04B.
W71-05695

OIL FIELD TECHNIQUES USEFUL IN WATER WELL DRILLING,
Southern California Water Co., Santa Barbara.
Harvey A. Mylander.
Water Well Journal, Reprint from Nov-Dec 1955, Jan 1956, and March 1956, 11 p, 17 fig, 2 tab, 8 ref.

Descriptors: *Rotary drilling, *Logging (Recording), Electrical well logging, Radioactive well logging.
Identifiers: *Pilot bore, Magna-Tector, Jet casing cutter, Bottom hole jet cutter, Temperative surveys, Pressure surveys, Flow surveys, Projectile perforating, Pneumatic well seal, Typical well completion costs, *Single-Shot Photographic Drift Indicator, *Multiple-Shot-Photographic Drift and Directional Indicator.

This article summarizes briefly some of the more useful oil field techniques that are fully developed and readily available for water well use. Pilot holes are usually drilled, then reamed to final diameter, in one or more passes. After the well bore is completed the casing is lowered into place and the space between is often packed with gravel. Early in the development of rotary drilling, it was evident that holes started straight at the surface but did not continue to be vertical as the bit penetrated steeply dipping beds of different hardnesses. The instruments used to determine drift and direction may be classed as (1) single-shot or (2) multiple-shot. Other instruments, such as electrical and radioactive logging are also of considerable use. Caliper instruments which measure hole diameter find common use for (1) determining intervals of significant caving (2) calculating the quantity of gravel necessary to properly gravel-pack the hole behind casing and (3) picking sections suitable for locating centering devices for the casing within the well bore. The Magna-Tector is a down-hole tool for locating the point at which pipe is stuck in a well, or the lowest point that it is free. Jet casing cutter and a bottom hole jet cutter also finds some application in alleviating stuck drill pipes and bits. Pneumatic well seals and charged perforating devices aid in converting abandoned oil wells to water wells. (Campbell-NWWA)
W71-05696

OIL WELL DRILLING TECHNOLOGY,
Arthur W. McCray, and Frank W. Cole.
University of Oklahoma Press, Norman, 1958. 492 p, 76 ref.

Descriptors: *Drilling, *Oil industry, Drilling equipment, Rotary drilling, Rock properties, Coring, Permeability, Geophysical methods, Geochemistry, Casing, Drilling fluids, Cements, Oil wells, Radioactive logging, Electrical logging, Logging (Recording).
Identifiers: *Petroleum reservoirs, Well planning, Power plants, Rotary operations, Drill strings, Drill bits, Hoisting operations, Drilling practices, Fishing tools, Formation evaluation, Pressure surges, Pressure anomalies, Casing design, Cementing operations, Drilling economics.

This book is the product of extensive research and practical investigation and is a comprehensive presentation of the procedures identified with this complex subject. It presents a thorough technical discussion of the geological and geophysical principles governing oil accumulation and the drilling of wells from the standpoint of the driller, petroleum engineers, geologist, and student. From a survey of the geological formations likely to contain deposits of oil, it proceeds to methods of discovery, including some radioactive prospecting methods, then to the various types of drilling and drilling tools, to cementing operations, and to costs and ways of paying drilling charges. Practical problems are posed and methods of solving them demonstrated. Graphs, charts, and figures are used freely, along with illustrations of many types of equipment, to aid the driller in visualizing the solution of problems. The experience oilman can find practical answers to many of his problems and questions, the student a sound text for basic principles of oil well drilling. The text provides a complete information on drilling techniques, whether the well is 100 or 20,000 feet deep. (Campbell-NWWA)
W71-05698

MASTER LIBRARY OF WATER WELL EQUIPMENT AND MAINTENANCE DATA,
National Water Well Association, Columbus, Ohio.
For primary bibliographic entry see Field 08G.
W71-05700

COLORADO RIVER FRONT WORK AND LEVEE SYSTEM--HYDRAULIC MODEL STUDIES FOR DEVELOPMENT OF MIXING AND RATING STRUCTURES--DELIVERY OF WATER TO MEXICO, A FEASIBILITY INVESTIGATION,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 08B.
W71-05722

DAM FAILURES: AN ASSESSMENT,
Resources Research Centre, Ottawa (Ontario).
A. K. Biswas, and S. Chatterjee.
Pap, Annu Meet Eng Inst Can, Ottawa, Can, Sept 1970. 28 p, 2 tab, 45 ref.

Descriptors: *Dam failures, *Damages, Dams, Disasters, *Concrete dams, *Earth dams, Spillway design flood, Dam foundations, Statistics, Floods, Safety, Reservoirs, Earthquakes, Investigations, Sliding, Landslides, Bibliographies, Operation and maintenance, Warning systems, Foreign.
Identifiers: Research, Dam stability, Overtopping, Spillway capacity, Canada.

Large dams and reservoirs create a complex new environment, and very little is known about the mutual interactions of the component forces to keep the newly created man-imposed systems and nature in a proper equilibrium on a long-term basis. Dams, like other structures, are subject to decay and deterioration with the passage of time and do fail occasionally. Many lessons can be learned from the study of dam failures. Several case studies of failures and disasters involving dams and reservoirs are presented. Careful analyses of more than 300 dams from all over the world indicate that: 35% of the failures are caused by exceedance of the spillway design floods; 25% are caused by foundation problems; and the remaining 40% have various causes such as improper design and construction, improper operation and maintenance, use of inferior-quality materials, and ice and wave action. Has 45 references. (USBR)
W71-05725

USBR VIBRATION TEST SYSTEM,
Bureau of Reclamation, Denver, Colo.
R. M. McCafferty.
Pap, 41st Shock Vib Symp, Air Force Acad, Colo Springs, Colo, Oct 1970. 9 p, 8 fig, 1 tab, 2 ref.

Descriptors: Seismic investigations, Research and development, Test procedures, *Seismic studies, *Test facilities, *Test equipment, Shock tests, Instrumentation, Frequency, Resonance, *Structural behavior, Structural engineering, Failu
Earthquake engineering, Dynamic tests, Dynar
response, Dynamic loads, *Vibration tests.
Identifiers: Vibration exciters.

The electrohydraulic vibration test system of
Bureau of Reclamation is described. The test
facility, testing equipment, control equipment,
strumentation, and analysis equipment of
system are discussed, and testing and analy
methods used on the present testing program
described. The system is used primarily for det
mining the structural response of reinforc
concrete specimens. Programs are being c
sidered for other dynamic problems such as str
ture-foundation interaction, hydrodynamic effe
dynamic material properties, and response of st
structures. The vibration test system is capable
testing a wide variety of specimens from very sm
to quite large masses, the upper limit of specim
size being restricted only by available space or
exciter rating. (USBR)
W71-05727

**RESEARCH PROGRAMS ON PIPELI
CROSSINGS,**
El Paso Natural Gas Co., Tex.
W. F. Quinn.
Proc Amer Soc Civ Eng, Transp Eng J ASCE,
96, No TE3, p 283-290, Aug 1970. 8 p, 5 tab,
ref, 2 append.

Descriptors: *Pipelines, *Railroads, *Highwa
*Crossings, Design standards, *Dead loads, *L
loads, Stress, Investigations, Resarch and devel
ment, Deflection, Elastic deformation, *Lo
(Forces), Bibliographies, Casings, Behavior,
ried pipes, Test results.
Identifiers: *Deflection measurement.

A history and summary report concerning the
tivities of the American Society of Civil Engine
Research Council on Pipeline Crossings of R
roads and Highways is given. The council
created to substantiate certain theories to be u
in the design criteria for cased and unca
pipeline crossings. The areas placed under
vestigation dealt with the physical performance
pipelines subjected to suface loadings, stres
resulting from external loadings and internal p
sure, forces acting on a buried pipeline result
from static and dynamic loadings, and the effec
passive resistance through soil support reacti
The three basic phases of the research progra
are: (1) field casing investigations; (2) passive
resistance investigations; and (3) laboratory
vestigations on 8-, 12-, and 24-in. pipelines. Has
references. (USBR)
W71-05728

**DESIGN, CONSTRUCTION, AND PE
FORMANCE OF CELLULAR COFFERDAMS,**
Woodward-Clyde and Associates, Inc., New Yo
and Cornell Univ., Ithaca, N.Y.
Y. Lacroix, M. I. Esrig, and U. Luscher.
Lateral Stresses Ground Design Earth-Retain
Struct, 1970, Spec Conf, Cornell Univ, Ithaca, N
p 271-328, June 1970. 58 p, 18 fig, 1 tab, 29 ref.

Descriptors: *Cofferdams, Cellular structu
Cells, Dams, Fills, Retaining walls, Design crite
Construction materials, Theory, Pile driving, C
struction, Performance, Safety factors, Earth p
sure, Sheet piling, Stability, Foundations, P
pressure, Seepage, Design, Bibliographies, C
struction methods, Design practices.
Identifiers: *Cellular cofferdams, Empir
methods.

First developed as a temporary structure to excl
water from excavations, cellular cofferdams
being used as temporary and permanent structu
to retain soil, water, or both. Cellular cofferda
are used in lieu of earth or rockfill cofferda
when the width of the structure must be sm
when a vertical face is required, or when stabi
against scour is required. Design theories, sig

t design and construction considerations, and formance of cellular dams are reviewed. Cellucofferdams normally are double-wall retaining ctures constructed of interlocking steel sheet s forming adjacent cells that are filled with soil ock fragments. Common shapes of cells are cir-ar, diaphragm, and cloverleaf. Cells may be arged along straight lines or lines having uniform variable curvatures. High cellular cofferdams be provided with a berm on the unloaded side ncrease stability. A berm of riprap may be prod on the water side to protect against scour. ular cofferdams are founded on rock where ible, and cell fill should be a face-draining esionless soil; however, many are founded on and some cell fills of rather impervious cohesoil have performed satisfactorily. Has 29 rences. (USBR)
1-05731

MPLETE ADJUSTMENT METHOD FOR ALYZING ARCH DAMS,
BA-CONSULPRESA, Lisbon (Portugal).
Serafim.
: Amer Soc Civ Eng, J Struct Div, Vol 96, No , p 1711-1734, Aug 1970. 24 p, 15 fig, 17 ref, 2 end.

criptors: Dams, *Concrete dams, *Arch dams, m design, Arches, *Analytical techniques, eign design practices, Bibliographies, Shell ctures, Displacements, Deformation, Stress ysis, Structural analysis, Stress, Cantilevers, arch dams, Computer applications, Matrix nods (Structural), Double-curvature arch s.
tifiers: Shell theory, Portugal.

method assumes the arch dam to be divided 2 systems--arches and cantilevers--formed by ssoirs (elements). In the voussoirs at the sing of arches and cantilevers, all internal es and external loads are considered and the plete set of equations of equilibrium is blished. Also considered are the 3 components near displacements and the 6 rotations of the nals to the faces. For continuity and equilibriof shear stresses, torsions of the horizontal and ical axes are not independent and vertical and ential displacements must be taken simultaney. Internal forces are obtained by solving a em of equations of compatibility which express al displacements at the crossing of arches and ilevers. Both systems of elements are analyzed triangular unit loads, for which the coefficient fluence of the various displacements are deterod. The method presents a matrix formulation he arches and a general formula for the cantils. Results obtained for 2 test dams using the nod show excellent agreement with results of erical methods developed in Great Britain. paring results of model tests for 5 double-curre arch dams indicates that the method is one e more exact. Has 17 references. (USBR)
-05733

LUENCE ON THE BEHAVIOUR OF AN CH DAM OF THE HYDROSTATIC PRESE ON THE GROUT CURTAIN AND OF THE ESSES IN THE GROUND UPSTREAM,
oratorio Nacional de Engenharia Civil, Lisbon tugal).
Rocha.
Int Congr Large Dams, Montreal, Can, Vol 4, st No 39, p 541-558, June 1970. 18 p, 16 fig, 4

criptors: *Concrete dams, Arch dams, Dam gn, Dams, Stress, Dam foundations, *Structural avior, *Hydrostatic pressure, Grout curtains, sile stress, Displacements, Cracks, Model tests, del studies, Effects, Foreign research, Design ria, Mathematical analysis, Test procedures, gn practices.
tifiers: Foundation models, Portugal.

Two phenomena usually not taken into account in the design of concrete dams are: (1) tensile stresses in the foundation rock upstream from the dam caused by downstream displacements of the dam under hydrostatic pressure; and (2) the influence of the action of hydrostatic pressure on the grout curtain. Model studies to determine the influence of these phenomena show that loading of a dam develops tensile stresses in the upstream foundation that can produce cracks when the stresses are not offset by a pre-existing compressive state of stress. The foundation cracks may influence the state of stress in the lower upstream zone of the dam. The influence can be considerable when the design is affected by tensile stresses in the upstream toe of the dam. The action of hydrostatic pressure on the grout curtain induces non-negligible stresses in the dam which usually improves the state of stress caused by hydrostatic pressure on the dam. (USBR)
W71-05734

8B. Hydraulics

RESPONSE OF OFFSHORE STRUCTURES TO RANDOM WAVE FORCES,
California Univ., Berkeley. Dept. of Structural Engineering.
Anil K. Malhotra, and Joseph Penzien.
ASCE Proceedings, Journal of the Structural Division, Vol 96, No ST10, p 2155-2173, October 1970. 19 p, 12 fig, 1 tab, 16 ref, 2 append.

Descriptors: *Waves (Water), *Offshore platforms, *Structural behavior, *Structural design, Structural stability, Design, Towers, Structural analysis, Deflection, Stress analysis, Structural engineering.
Identifiers: *Offshore structures, *Wave forces.

The structural response of towers in deep waters can be reasonably well estimated through a statistical approach which assumes sea flow conditions as stationary gaussian processes by the one-dimensional wave height spectrum and Airy's linear wave theory. Extreme value statistics enable computation of the most probable peak values of the structural response. The response of a tower can be represented fairly accurately by considering only the first two or three lateral modes of vibration. It is desirable to set the leg spacing for the tower in the region of half the wave length, corresponding to the peak frequency of the wave height spectra. As this peak frequency is a function of the wind velocity, a number of alternative critical velocities may have to be examined. A symmetrical structure subjected to symmetrical flow will not experience cross drag inertial forces; thus, no torsional stresses will be introduced. However, due to eccentricities and cross flow, torsional stresses will be introduced and should be checked. These stresses can be significant when the first torsional mode and the first bending mode have frequencies which are close together. (Knapp-USGS)
W71-05368

HYDRAULIC TESTING OF HOLE UAe-7h, AMCHITKA ISLAND, ALASKA,
Geological Survey, Denver, Colo.
Wilbur C. Ballance.
Available from NTIS, Springfield, Va 22151 - Price $3.00 printed copy; $0.65 microfiche. Geological Survey Report USGS-474-484, 1970. 35 p, 15 fig, 1 tab, 2 ref. USAEC Agreement No AT (29-2)-474.

Descriptors: *Groundwater movement, *Hydraulic gradient, *Drill holes, *Water yield, *Alaska, Aquifers, Drawdown, Injection wells, Test procedures, Pumping, Specific capacity, Water levels, Transmissivity, Hydraulic conductivity, Velocity.
Identifiers: *Underground chamber, Swabbing recovery test.

Hole UAe-7h was hydraulically tested in support of the U.S. Atomic Energy Commission's underground nuclear testing program on Amchitka Island, Alaska. Five zones were tested by isolating them with straddle packers. Water bypass around the packers occurred during two of the tests. Because of unstable borehole-wall conditions, favorable locations for setting packers were scarce. The hole was drilled into an intrusive contact zone consisting of highly fractured, hydrothermally altered andesites, metamorphosed breccias, hornfels, and intities. The hole was very difficult to drill because the fractured rock constantly caved from the hole wall and considerable time was required to clean the caved material from the hole. The constant caving resulted in an enlarged borehole often beyond the capacity of the packers to expand. The relative specific capacity (computed from injection test data) of the tested intervals ranges from 0.65 to 1.94 cubic meters per day per meter (0.037 to 0.109 gallons per minute per foot) of drawdown. (Woodard-USGS)
W71-05371

FLOOD ROUTING THROUGH STORM DRAINS: PART IV - NUMERICAL COMPUTER METHODS OF SOLUTION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and A. H. Barnes.
Colorado State University Hydrology Paper No 46, November 1970. 47 p, 16 fig, 4 tab, 6 ref, 3 append. Bureau of Public Roads supported.

Descriptors: *Computer programs, *Flood routing, *Storm drains, *Numerical analysis, Mathematical studies, Routing, Equations, Unsteady flow, Mathematical models, Waves (Water), Critical flow, Supercritical flow, Flow, Storm runoff.
Identifiers: Storm drain flow routing.

Computer-oriented numerical methods are given for solving the Saint-Venant quasi-linear hyperbolic partial differential equations of gradually varied free-surface unsteady flow for storm drains. Various numerical finite-difference schemes, including explicit schemes based on the two partial differential equations, unstable diffusing, upstream differencing, leap frog, Lax-Wendroff, and the specified intervals scheme are analyzed. The specified intervals scheme (derived from the method of characteristics), the Lax-Wendroff scheme, and the diffusing scheme are compared. Flow charts and computer programs for these various numerical methods are given. (Knapp-USGS)
W71-05376

PROCEDURE FOR COMPUTING THE ELASTIC SEEPAGE REGIME IN CONFINED AQUIFERS,
S. N. Numerov, and R. M. Barsegyan.
TT-55062. Available from NTIS. Translation of Izvestiya Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrotekhniki, Vol 86, p 48-59, 1968. Transactions of the Vedeneev All-Union Scientific Research Institute of Hydraulic Engineering, Vol 86, p 43-54, Israel Program for Scientific Translations 1970. 12 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Groundwater movement, *Confined water, *Aquifers, *Darcys law, *Elasticity (Mechanical), Permeability, Transmissivity, Aquicludes, Compressibility, Percolation, Seepage.
Identifiers: *Elastic seepage.

A procedure is given for computing nonsteady seepage, according to Darcy's law, of groundwater in confined aquifers when the elasticitics of the liquid, and low-permeability strata are taken into account. It is assumed that the low-permeability stratum is homogeneous, and that the permeabilities of the aquifers vary only in the vertical direction. The following assumptions are made: (1) seepage in the low-permeability stratum is vertical; (2) the piezometric heads in the aquifers are constant in the vertical direction. (Knapp-USGS)
W71-05455

SOLUTION OF A BOUNDARY VALUE PROBLEM OF NONSTEADY SMOOTHLY VARYING FLOW OF A LIQUID BY THE IMPLICIT FINITE-DIFFERENCE METHOD,
A. I. Fedorenkov.
TT-55062. Available from NTIS. Translation of Izvestiya Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrotekhniki, Vol 86, p 127-133, 1968. Transactions of the Vedeneev All-Union Scientific Research Institute of Hydraulic Engineering, Vol 86, p 121-127, Israel Program for Scientific Translations 1970. 7 p, 2 fig, 3 ref.

Descriptors: *Open channel flow, *Numerical analysis, *Unsteady flow, Mathematical studies, Equations, Linear programming, Boundary processes.
Identifiers: Samt-Venant equation.

An implicit finite-difference method is presented for solving the boundary-value program for Saint-Venant's equation, which describes nonsteady smoothly varying open-channel flow. The derivatives along the flow, are replaced by symmetric finite-difference ratios at interior points of the stretch considered, and by finite-difference equations. (Knapp-USGS)
W71-05457

FINITE-DIFFERENCE SCHEMES COMPARED FOR WAVE-DEFORMATION CHARACTERISTICS IN MATHEMATICAL MODELING OF TWO-DIMENSIONAL LONG-WAVE PROPAGATION,
Army Coastal Engineering Research Center, Washington, D.C.
R. J. Sobey.
CERC Technical Memorandum No 32, Nov 70. 36 p, 5 ref.

Descriptors: *Waves, *Mathematical models, *Tides.
Identifiers: Long waves, *Wave propagation, Finite-difference schemes, *Storm surge, Tides.

The wave-deformation characteristics of several difference schemes for two-dimensional long-wave propagation are compared by means of the propagation factor introduced by J. J. Leendertse. The schemes compared are those proposed by N. S. Heaps, R. O. Reid and B. R. Bodine, J. J. Leendertse, and M. B. Abbott, respectively. The study also demonstrates the differing behavior of explicity and implicit schemes. (CERC)
W71-05654

MEASURING DIRECTIONAL VELOCITY IN WATER WAVES WITH AN ACOUSTIC FLOWMETER,
Army Coastal Engineering Research Center, Washington, D.C.
R. H. Multer.
CERC Technical Memorandum No 31, Apr 70. 27 p.

Descriptors: *Oceanography, *Instrumentation, *Waves, *Flowmeters.
Identifiers: Dynamic oceanography, Wave-direction sensor, Acoustic flowmeter.

This report contains the technical details of an investigation which was undertaken to adapt an acoustical flowmeter to a device for measuring velocities in water-wave phenomena. The flowmeter studied was designed to measure the difference in travel times of two acoustical pulses traveling simultaneously in opposite directions along a common path. Because of viscous effects, a zone of low velocity flow occurs behind each probe and the measured velocity is somewhat less than the actual velocity when the angle between the acoustical path and velocity vector, theta, is small. When this angle is relatively large, the wake has little effect on the velocity and V measured = V actual x cos theta. It is shown in this report that the wake effect may be eliminated by making simultaneous measurements along multiple paths. (CERC)
W71-05656

CERC WAVE GAGES,
Army Coastal Engineering Research Center, Washington, D.C.
Leo C. Williams.
CERC Technical Report No 30, Dec 1969. 124 p.

Descriptors: *Ocean waves, *Instrumentation.
Identifiers: Ocean-wave gages, Oceanographic instrumentation, Step-resistance wave gages, Strip-chart wave records, Wave-record analyzer (Magnetic tape).

CERC has used wave gages to gather prototype wave data since 1948. Two basic types of gages are now used in the field - the step-resistance staff gage and the underwater pressure-sensitive gage. CERC has developed three types of step-resistance staff gages - a series type for use in fresh water, a parallel type for use in salt water, and a relay-operated type for use in either fresh or salt water or in water where wide changes in salinity occur. The pressure gage can be used in water of any salinity. The series and parallel gages have an accuracy of plus or minus 5 percent plus the spacing of one sensor increment. The relay gage has an accuracy of plus or minus 2 percent plus the spacing of one sensor increment. The accuracy of the pressure-sensitive gage is not as precise as that of the step-resistance gages. The report describes each gage and the theory of operation, details of fabrication, steps for calibration and installation, and requirements of maintenance. (CERC)
W71-05659

BULLETIN AND SUMMARY OF RESEARCH PROGRESS, FISCAL YEARS 1967-69.
Army Coastal Engineering Research Center, Washington, D.C.

CERC Bulletin III, July 1970. 72 p.

Descriptors: *Coastal engineering, Shore protection, *Riprap, Ecology, *Beach erosion.
Identifiers: Shore processes, *Environmental data collection, Sediment tracers, Wave diffraction, Hurricane protection, Beach nourishment.

This Bulletin consists of 3 articles and a summary of CERC research for FY's 1967-69. The lead article describes hurricane protection in New England harbors. Operation of the gates is described; and based on records of storms since 1935, prevention of losses is projected. A Method for Driving Pipe in Beach Rock describes placing pipe economically to obtain beach profiles without surveying. Wave Diffraction in a Laboratory Movable-Bed Setup discusses how diffraction causes deleterious results. Summary of Research: Wind-Wave Action in Coastal Waters - Studies in coastal areas and wave tanks reported. Shore Processes - CERC studies cover alongshore transport, suspended material, sand simulants, beach profiles and dune building. Long-Period Waves and Surges - Analyzes harbor surging, tsunamis, 2-dimensional long waves. Shore Protection in Bays, Lakes and Reservoirs - Study in Chesapeake Bay by CERC. Biological-Ecological Studies - Program to use offshore sources of sand to nourish beaches; create bottom conditions favorable to marine life; research the effects of waste dumped in the N.Y. Harbor. Environmental Data Collection - CERC studies on sand inventory, sand tracers, wave analysis, wave sensors and surf observation. A laser wave gage was tested at Atlantic City, N.J. Publications - A list of publications for FY's 67-68-69. Miscellaneous Tests - Riprap in reservoirs of the Missouri River Division; sand-filled nylon bags; synthetic seaweed; special techniques for coastal construction; corrosion of steel piling in sea water; and sand slurry abrasion of coated steel pilings. (CERC)
W71-05662

LONGSHORE CURRENT OBSERVATIONS IN SOUTHERN CALIFORNIA,
Corps of Engineers, Washington, D.C. Beach Erosion Board.
Francis P. Shepard.
Available from NTIS as AD-699 391, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No 13, Jan 1950.
Identifiers: *Beaches, Erosion, *Ocean currents, California, Ocean waves, Periodic variations, Ocean bottom topography, Surf, *Longshore currents, Beach erosion.

Ocean currents were measured in the surf zone at frequent intervals throughout a year at stations along the southern California coast from the Mexican border to Newport. Results are given.
W71-05673

GENERAL INDUSTRIAL WATER WELL DESIGN FACTORS,
Layne Texas Co., Houston.
O. F. Jensen.
Typescript, 1961. 29 p.

Descriptors: *Water wells, *Drilling, Rotary drilling, Cementing, Aquifers, Specific capacity, Sampling, Drilling equipment, Drawdown, Groundwater.
Identifiers: *Well hydraulics, *Well development, Pilot holes, Calbe tool drilling, Quantitative hydrology, Pump tests, Well interference.

Industrial water well design may best be defined as a progressive quantitative evaluation using engineering principles of several scientific fields. This procedure must necessarily be coordinated with the methods of testing and construction. The design must be based on the natural geologic, hydrologic and chemical conditions of the groundwater prevailing in the area of a proposed well. The pumping rate, or yield, and quality of water produced are direct functions of these natural conditions. The design of a water well system embraces several phases. The preliminary survey of the proposed well location together with the drilling of a test hole or pilot hole survey provide basic data on the prevailing geologic, hydrologic and chemical quality of the goundwater conditions in a proposed area. These data together with application of water well testing and construction methods provide the basis for determining a well design that will result in the most favorable operational performance. The preliminary survey, test hole or pilot hole survey of a proposed well location, construction methods and well hydraulics are discussed in this paper. (Campbell-NWWA)
W71-05691

WELL DEVELOPMENT, A PART OF WELL COMPLETION,
Williams and Works, Grand Rapids, Mich.
Edward M. Burt.
Typescript, 1970. 15 p.

Descriptors: *Water wells, *Wells, Drilling, Groundwater, Equipment, Rotary drilling, Gravel packing, Casting, Turbine pump, Muriatic acid, Screens, Michigan.
Identifiers: Cable tool drilling, Water well construction, Surge block, Horizontal jet nozzle, Air-lift pump, Vertical turbine pump, Explosives, Chlorination.

The object of this paper is to emphasize that part of water well completion known as well development. Some of the available tools are illustrated and various techniques discussed. It illustrates the fundamental elements of the basic types of wells found in Michigan, wherever water bearing unconsolidated formations rest on water bearing formations. The purpose in well development during the construction of a well, is to accomplish the design goal of maximum, sand-free capacity. In the design phase the selection of a screen and whether or not artificial gravel packing is necessary, combined with the selection of the method of drilling, are the important considerations. The paper is well documented and well illustrated. (Campbell-NWWA)
W71-05692

OLORADO RIVER FRONT WORK AND
EVEE SYSTEMa-HYDRAULIC MODEL STU-
ES FOR DEVELOPMENT OF MIXING AND
ATING STRUCTURES--DELIVERY OF
ATER TO MEXICO, A FEASIBILITY IN-
ESTIGATION,
reau of Reclamation, Denver, Colo. Engineering
d Research Center.
L. King.
ailable from NTIS as PB-196 303, $3.00 in
per copy, $0.95 in microfiche. Report REC-
CE-70-8, October 1970. 51 p, 43 fig.

escriptors: *Salinity, *Design data, Appur-
nances, Stream pollution, Hydraulic structures,
ckwater, Channels, *Discharge measurement,
ver currents, *Model tests, Hydraulics, Open
annel flow, Sampling, Channel improvement,
boratory equipment, Velocity meters, Water
ality, Water analysis, Water sampling, *Mixing.
ntifiers: Fluorometers.

e discharge rating curve for the Colorado River
the Northern International Boundary with Mex-
is variable because of the shifting bed. Lack of
xing in the channel results in a nonuniform dis-
bution of salinity and pollutants, requiring
quent and expensive sampling procedures to ob-
n reliable data. Hydraulic model studies were
rformed to determine the feasibility of an im-
oved, permanent rating structure and devices to
omote mixing of the water in the river. Structures
e suggested for an unimproved and an improved
annel configuration.
71-05722

RBULENT MIXING IN SUBMERGED TWO-
MENSIONAL WALL JETS,
nnessee Univ., Knoxville. Dept. of Engineering
echanics.
S. Chu, and C. J. Remenyik.
ailable from the NTIS Service as PB-198 029,
.00 in paper copy, $0.95 in microfiche. Report
M 71-2, December, 1970. 32 p, 17 fig, 5 ref.
WRR Project B-007-TENN (1).

escriptors: Turbulent flow, *Wall jet, *Mixing,
ot wire anemometer, *Water pollution sources,
ddy viscosity, *Eddy diffusion coefficient,
hermal pollution.

plane, horizontal, two-dimensional, incompressi-
e, turbulent wall-jet of air was studied experimen-
ly. The air flow emerged from a 35 in. wide,
52 2 in. high slot at 110 ft/sec tangentially to a 35
by 143 in. horizontal flat plate bounded by
eboards. Mean and turbulent flow charac-
istics were measured in the similarity and the en-
nce regions up to a distance of 123.6 nozzle
ights from the nozzle exit. Mean velocity
rections and components of the Reynolds stress
nsor were measured with a single rotatable hot
re. Magnitudes of the mean velocity were ob-
ned with a Pitot tube. The hot wire set was a con-
nt temperature hot wire anemometer equiped
th a linearizer. Results indicate that the distribu-
ns of the mean velocity directions do not
come similar with increasing distance from the
zzle. The self-similar form of the non-dimen-
nal mean velocity profile develops within a
stance of about 9 nozzle heights from the nozzle
it. It appears that the various turbulence intensi-
s and the Reynolds shear stress reach similarity
tes at different distances between 16.3 and 20.1
zzle heights from the nozzle exit. The concept of
dy viscosity does not promise to be very useful in
aling with wall jets. Values determined with mea-
red Reynolds shear stresses and mean velocity
adients show that the eddy viscosity changes very
pidly and in a complex way in the vicinity of the
ll and has even a singularity at or near the locus
mean velocity maxima.
71-05767

8C. Hydraulic Machinery

HIGH HEAD GATE SEAL STUDIES,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Edward J. Traut.
Available from NTIS as PB-195 741, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-37, August 1970. 18 p, 2 tab, 11 fig.

Descriptors: *Gate seals, *High pressure gates, High pressure, Seals, Stoppers, Test procedures, *Laboratory tests, Physical properties, Hydraulic gates and valves, Friction, Test facilities.
Identifiers: *High head, Fluorocarbons, Friction coefficient (Mech), Test results.

Studies were continued on rubber seals to determine the most suitable seal for use on wheel and roller-mounted gates operating under very high heads. The major problem encountered during the closing cycle under unbalanced pressure conditions is the pinching of the seal bulb between the seal clamp and seal seat. Seven factors affecting this pinching were varied in attempts to find the optimum seal assembly capable of withstanding high pressure heads. Ten double-stem seal variations using combinations of stem thickness, fluorocarbon cladding, and rubber compositions were tested at heads up to 600 ft (182.88 m). Tests were conducted in a special test rig accomodating 12-1/8-in.-long (30.798-cm) seal specimens. Tests consisted of measuring the seal bulb extension and photographing and observing general behavior of the seal under load during simulated opening and closing cycles of the gate.
W71-05459

AUSTRALIAN-AMERICAN INTERBASIN WATER TRANSFER,
Colorado Univ., Boulder. Dept. of Geography.
For primary bibliographic entry see Field 06D.
W71-05477

SOME RESULTS OF MODEL TESTS ON FRANCIS HYDRAULIC TURBINES,
N. T. Klyuikov.
Available from NTIS as PB-193 632T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation, Denver, Colo. Trans. from Energomashinostroyenie No 4. Translation No 708, August 1967. 16 p.
Identifiers: *Turbines, *Turbulence, Vortices, Turbine blades, Cavitation, Hydraulic systems, Model tests, Vibration, USSR, Francis turbines, Turbine runners, Translations.

Investigation of vortical turbulence behind Francis turbine runner models showed the causes for formation of vortical turbulence behind the runner, leading to increased cavitation and vibration of the unit. Five different models of runners having a constant draft tube height with a greater than critical cavitation coefficient were compared by visual observation, velocity measurements, linear measurements of vortical flow diameter parallel to and 100 mm from the lower plane of the band, and ratio of the diameter of vortical disturbance to the diameter of the draft tube entrance. Then the results of flow torsion measurements at the runner exit were compared with the calculated data obtained by computing the effect of the distributor. Conclusions were: (1) Vortical turbulence behind runner is caused by a torsion of flow at the runner outlet. (2) During runner design calculations, flow torsion at the runner exit should be considered, taking into account the unevenness of the flow torsion created by the distributor. (3) For Francis turbines with a specific speed of 200, the flow torsion can be defined satisfactorily and the meridional projection of the blades chosen so that the hub velocity equals zero or is slightly negative. (Translator)
W71-05667

SHORT-CIRCUIT FORCES IN SWITCHGEAR INSTALLATIONS,
G. Schaffer.
Brown Boveri Rev, Vol 57, No 6/7, p 303-309, June-July 1970. 7 p, 10 fig, 11 ref.

Descriptors: *Short circuits, Stress, *Switchgear, Electrical equipment, Oscillations, Magnetic fields, Bus (Electrical), *Bundled conductors, Electric current, Electric fields, *Electric conductors, Electric cables, Plastic deformation, Foreign research, Electrical.
Identifiers: Engincering, Transmission (Electrical), Switzerland.

The physical causes, behavior with respect to time, and form of the forces acting between live conductors are considered, and design measures for dealing with short-circuit forces in switchgear installations are discussed. The forces created by a short circuit are not static, but oscillate at twice the power frequency. Danger exists if the natural frequency of the bus bar is close to double the power frequency because resonance can occur. Mechanically strong (rigid) bars usually transfer much greater forces to post insulators than do mechanically weak bars. Bundled conductors encounter 2 kinds of stresses, those between phase conductors and those between the conductors of the bundle. Bundle forces are large because of the proximity of the conductors. As a result of the large bundle forces, conductors move rapidly toward each other during short circuits, causing a shortening of the span and high stresses on equipment. Suspended connections and jumpers swinging violently under the influence of short circuits are particularly vulnerable in high-voltage equipment. Electrical clearances may be greatly reduced under these conditions. Care must be taken with bundled conductors in outdoor switchgear where short-circuit currents may exceed 70,000 amperes. (USBR)
W71-05724

UNBALANCED TENSIONS IN TRANSMISSION LINES,
Pacific Gas and Electric Co., San Francisco, Calif.
D. B. Campbell.
Proc Amer Soc Civ Eng, J Struct Div, Vol 96, No ST10, p 2189-2207, Oct 1970. 19 p, 13 fig, 1 tab, 8 ref, 2 append.

Descriptors: Electric conductors, Computers, *Transmission lines, Ice loads, *Matrix methods (Structural), *Transmission towers, Structural engineering, *Stiffness, Numerical analysis, Electrical insulators, Suspension insulators, Digital computers, Structures, Accuracy, Errors, *Tension, Torsion, Bending, Analysis, Computer applications.
Identifiers: Iteration method.

A nonlinear analysis of an electric transmission line is presented for conditions involving imbalance in conductor tensions. The analysis is applicable to lines containing structures of arbitrary geometry and stiffness. Structure and insulator displacements are considered. Stiffness properties of structures, conductors, and insulators are derived. Equilibrium equations to be used in the analysis are formed. Two numerical methods of analysis, an iteration method, and a step-by-step linear increment technique are applied to the equilibrium equations. Both methods were programed on a digital computer and were applied to an actual transmission line containing flexible tubular steel structures. The iteration method was superior to the step-by-step method. Analysis of this line also shows that neglecting deflections of flexible structures with suspension insulators introduces substantial error. (USBR)
W71-05726

8D. Soil Mechanics

COMPARISON OF THE RESULTS OF LABORATORY TESTS WITH DATA OBTAINED BY FIELD OBSERVATIONS OF THE

PERFORMANCE OF THE DRAINAGE SYSTEM IN THE SOIL MASSIF ON THE LEFT BANK OF THE BRATSK HYDROELECTRIC PLANT,
O. N. Nosova.
TT-55602. Available from NTIS. Translation of Izvestiya Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrotekhniki, Vol 86, p 68-75, 1968. Transactions of the Vedeneev All-Union Scientific Research Institute of Hydraulic Engineering, Vol 86, p 63-70, Israel Program for Scientific Translations 1970. 8 p, 3 fig, 1 ref.

Descriptors: *Drainage systems, *Anisotropy, *Analog models, Model studies, Drainage wells, Reservoirs, Dams, Subsurface drainage, Hydroelectric plants.
Identifiers: *Bratsk (USSR).

Electrical analog models were used to study and plan a drainage system for anisotropically fissured rock at the Bratsk power station, USSR. The drained area consists of lower Silurian sandstone and siltstone covered by a thin layer of Quaternary sediments of low permeability, with underlying thick layers of trap intrusions of diabase which are practically impervious. The permeability of the sandstone and siltstone increases from the bottom toward the top. Certain layers in the central and upper parts of the aquifer have permeabilities exceeding 100 m/day. Due to the geological structure of the site the seepage conditions are most unfavorable. Tests carried out on a three-dimensional electrical-analogy installation at the Seepage Studies Laboratory showed that construction of a grout curtain is not advisable, and that favorable seepage conditions in the central part of the zone considered can be ensured solely by a drainage system. The drainage system consists of a single drainage gallery and a number of drainage tunnels. Both the gallery and the tunnel were to be equipped with vertical drainage wells spaced 10 m from one another. Drainage systems consisting of vertical wells were found to be of little value for lowering the saturation surface in anisotropic fissured rock, since leaks may occur over considerable lengths. (Knapp-USGS)
W71-05456

ON THE PROBLEM OF DERIVING A SYSTEM OF EQUATIONS DESCRIBING THE MOTION OF WATER-SATURATED COHESIONLESS SOIL CONSIDERED AS A MULTIPHASE MEDIUM,
L. A. Eisler.
TT-55062. Available from NTIS. Translation of Izvestiya Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrotekhniki, Vol 86, p 236-245, 1968. Transactions of the Vedeneev All-Union Scientific Research Institute of Hydraulic Engineering, Vol 86, p 231-239, Israel Program for Scientific Translations , 1970. 9 p, 9 ref.

Descriptors: *Sediment transport, *Soil mechanics, *Mass wasting, Compressive strength, Shear strength, Soil physical properties, Flow, Mudflows, Fluid friction, Porous media.
Identifiers: Water-saturated soil.

Soil may be considered as a multiphase medium in which one phase forms the skeleton. The three-dimensional equations of motion for a multiphase medium are written and solved. When the soil contains little air, and surface forces at the interfaces as well as heat exchange between the phases is neglected, it may be assumed that all phases except the skeleton are at the same pressure. The volume strain induced by the effective pressure in the skeleton has to be added to the volume strain of the solid particles, caused by the water pressure. The ratio of these strains must be found by considering the mechanics of the deformation of the soil skeleton and of the particles of which it is composed. When the air content is insignificant the model of the three-phase soil may be simplified and reduced to the model of a two-phase soil. (Knapp-USGS)
W71-05458

MECHANICS OF SLIDE DAMS,
Agbabian-Jacobsen Associates, Los Angeles, Calif.
G. A. Young.
Pap, Symp Eng Nucl Explos, Las Vegas, Nev, p 1198-1221, Jan 1970. 24 p, 21 fig, 20 ref.

Descriptors: *Earth dams, *Rockfill dams, *Nuclear explosions, *Dam construction, Dam design, *Landslides, Dams, Soil mechanics, Mechanics, Model studies, Model tests, Rockslides, Slopes, Construction, Design criteria, Laboratory tests, Bibliographies, Scale effect, Construction methods, *Explosive construction.
Identifiers: *Slide dams.

Problems associated with the construction of slide dams by nuclear explosives are considered. Characteristics of conventional earth and rockfill dams based upon proven techniques developed after many years of experience are examined, and characteristics of natural landslide dams are considered to identify potential problems that must be over-come by slide dam construction techniques. Mechanics of slide dams as determined from small-scale laboratory studies are presented. Many important features of conventional dams must be incorporated into the design of slide dams. For example, foundation treatment and adequate diversion and spillway capacity must be provided, and adequate provisions must be made to control seepage and prevent piping. Important lessons can be learned from observing the characteristics of natural landslides; however, slide dams created by man must provide better results than have been observed in nature. Limited laboratory studies helped define the general phenomena of the mechanics of slides and indicated that the phenomena can be scaled. Conclusions are that slide dams can be constructed and that small-scale field tests and additional laboratory studies are justified. Has 20 references. (USBR)
W71-05729

METHODS OF ESTIMATING LATERAL LOADS AND DEFORMATIONS,
Alberta Univ., Edmonton.
N. R. Morgenstern, and Z. Eisenstein.
Lateral Stresses Ground Design Earth-Retaining Struct, 1970, Spec Conf, p 51-102, Cornell Univ, Ithaca, NY, June 1970. 52 p, 19 fig, 1 tab, 65 ref, append.

Descriptors: *Lateral forces, *Earth pressure, Loads (Forces), Stress, *Soil mechanics, *Deformation, Retaining walls, Soil pressure, Effective stress, Elastic theory, Safety factors, Cuts, *Analytical techniques, At rest pressure, Strain, Theory, Methodology, Boundary conditions, Foreign design practices, Bibliographies, Finite element method.
Identifiers: Empirical methods, Canada.

Methods for estimating lateral earth pressures and deformations are classified into 3 groups: (1) problems of small deformations where lateral pressures and deformations may be computed using elastic theory; (2) problems of small to moderate deformations where lateral pressures are computed using limit equilibrium methods and deformations are controlled by choice of a suitable factor of safety; and (3) problems of moderate to large deformations where lateral pressures and deformations are estimated by semiempirical methods. Application of each method within the 3 groups is subject to limitations. An important limitation occurs because of lack of knowledge of boundary conditions such as those that describe the way walls move, the way excavations are braced, and the stress displacement conditions away from the zone of concern. Successful application of any method can be expected only if soil and pore pressure data are representative. Questions of time dependence of strength or anisotropy may be very important in estimating lateral pressure, and changes in pore pressure and subsequent consolidation may control deformation; in most cases where these unknowns prevail, use of the more advanced theories is superfluous. Has 65 references. (USBR)
W71-05730

DESIGN, CONSTRUCTION, AND PERFORMANCE OF CELLULAR COFFERDAMS,
Woodward-Clyde and Associates, Inc., New York; and Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 08A.
W71-05731

CONSTANT LOADING RATE CONSOLIDATION TEST,
Hiroshima Univ. (Japan)
H. Aboshi, H. Yoshikuni, and S. Maruyama.
Soils Found, Vol 10, No 1, p 43-56, Mar 1970. 14 p, 13 fig, 1 tab, 1 photo, 8 ref.

Descriptors: Consolidation, *Soil consolidation tests, Soil mechanics, Soil engineering, *Soil tests, Laboratory tests, Test procedures, Clays, *Loading rate, Preconsolidation, Methodology, Theory, Foreign research, Pore pressure, Settlement (Structural), Preconsolidated soils, Effective stress, Comparative studies.
Identifiers: Compression index, Consolidometers, Time saving, Japan.

Frequent measurements for about 10 days are usually required to determine consolidation characteristics of clayey soils by the standard consolidation test. For this reason, the standard test is considered one of the most time consuming and troublesome among routine laboratory soil tests. A consolidation test method using constant rates of loading is proposed as an alternative to the standard test. Consolidation tests using the proposed method are completed in 2 to 3 hr, and settlement and base pore pressure can be measured and recorded automatically. Results from the proposed test agree well with those from the standard test. Test procedures, theoretical background, and experimental data are presented. (USBR)
W71-05732

8E. Rock Mechanics and Geology

IMPOUNDING OF MANICOUAGAN 5 RESERVOIRS AS POSSIBLE TRIGGER CAUSE OF LOCAL EARTHQUAKES,
SNC, Inc., Montreal (Quebec).
R. Kall, and S. Charalambakis.
10th Int Congr Large Dams, Montreal, Can, Vol 3, Quest No 38, p 795-814, June 1970. 20 p, 5 fig, 52 ref.

Descriptors: *Reservoirs, *Seismic studies, *Subsidence, *Earthquakes, Faults (Geology), Subsurface investigations, Stress, Instrumentation, Settlement (Structural), Dams, Geology, Breccia, Foreign research, Water pressure, Bibliographies, Safety, Seismology, Investigations, History, Seismic stability.
Identifiers: Canada, Seismic sources, *Manicouagan 5 (Canada), Tectonics.

In view of several recorded case histories, loading of the Manicouagan 5 Reservoir could trigger local earthquakes. Impounding of the reservoir is in progress and studies have been made of the impounding at Hoover Dam reservoir in the U.S., the filling of Kremasta and Marathon Lakes in Greece, the pressure-filling of a deep well near Denver, Colo. (in the U.S.), and other cases where loading of a relatively small area of the earth's crust has triggered local earthquakes. Loading and subsidence of reservoir areas are not sufficient for causing earthquakes; tensions must be present in the crust so that unstable conditions prevail under the reservoir area. Only then can an extra load become a trigger to release earthquakes. The Manicouagan 5 Reservoir area is very unique and possibly an unstable structure. The origin of the well-defined, circular feature dates back to a meteor impact in the Triassic period. The explosion created a circular graben structure, the major faults being occupied by Lakes Manicouagan and Mushalagan. Rocks of the reservoir area are different from those of the surrounding Shield, being crushed, brecciated, fragmented, and fractured to a

reat depth. The reservoir area is isostatically unable and presumably in a process of uplift. USBR)
/71-05735

F. Concrete

OW-HYGROSCOPIC PLASTICIZED LUGGING CEMENT,
ureau of Reclamation, Denver, Colo.
. N. Khangil'din.
vailable from NTIS as PB-193 590T, $3.00 in aper copy, $0.95 in microfiche. Translated from: sement, No 4, p 5-7, 1965. Bureau of Reclamaon Translation No 663, May 1966. 11 p, 3 fig, 3 b, 3 ref.
entifiers: *Well completion, *Ethanolamines, ortland cement, Translations.

oviet researchers have developed a new highuality plugging cement for use in oil prospecting evelopmental work in Siberia. The good storage operties and wettability of this cement were obined by adding monoethanolamine during illing. Because a better storing cement was eeded for cold humid conditions, a research team om several institutes cooperated to determine hat additives yielded the best plugging cement in rms of wettability, strength, viscosity, and other operties. Amino alcohols, mono-, di-, and iothanolamine, were tested using both high- and w-aluminate cements with and without sodium loride. The paper discusses the properties eeded in the new cement, developmental test ethods, and results leading to the choice of onoethanolamine as the most effective additive r cold or hot drill holes at the recommended rate 0.5 to 1%, by weight of cement. Slag-portland ement (40% slag) with admixtures of 1% NaCl nd 0.5% monoethanolamine during milling kept a gher strength and flowability in spite of the NaCl ontent (added to raise the hygroscopic properes). Monoethanolamine lowers water permeabilit of cement mortar, does not corrode iron, intensies the milling process to produce finer grinds, ineases water-cement ratio, and lowers the specific eight of the grout (important when grouting deep ill holes).
/71-05463

ECHANICAL BEHAVIOR OF CONCERETE XAMINED BY ULTRASONIC MEASUREENTS,
inois Univ., Chicago.
P. Shah, and S. Chandra.
Mater, Vol 5, No 3, p 550-563, Sept 1970. 14 p,) fig, 1 tab, 8 ref.

escriptors: *Concrete tests, Concretes, Attenuaon, *Cracking, Fractures, Nondestructive tests, atigue (Materials), *Ultrasonics, Microstructure, echanical properties, Failure (Mechanics), rain, Sensitivity, Cracks, Measurement, Concrete chnology, Sound waves, Concrete properties, Sonic velocity tests, *Ultrasonic tests.
entifiers: *Crack propagation, Microcracks, onic-pulse test.

ltrasonic measurements were used successfully as ternal indicators of changes in internal microsuctures of concrete subjected to monotonically creasing, cyclic, and sustained loading. The elocity and attenuation of ultrasonic pulses transitted across concrete and paste speciments subcted to various types of loading were measured nd compared to surface strains and internal icrocracking. Conclusions are: (1) sonic pulse elocity decreases with increasing length of cracks; 2) increasing the resonant frequency of the ezoelectric crystals used to produce the sonic ulses increases the pulse velocity and the sensitivi of the ultrasonic measurements to crack growth; 3) failure of concrete involves much more gradual nd extensive crack growth than failure of paste; 4) cyclic and sustained loading of concrete results a relatively slow rate of crack growth when failure does not occur, and as failure approaches, the rate of crack growth increases and ultrasonic measurements change very rapidly; and (5) ultrasonic measurements are helpful in contrasting failure mechanisms of sustained and cyclic loading. (USBR)
W71-05723

USBR VIBRATION TEST SYSTEM,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08A.
W71-05727

INFLUENCE ON THE BEHAVIOUR OF AN ARCH DAM OF THE HYDROSTATIC PRESSURE ON THE GROUT CURTAIN AND OF THE STRESSES IN THE GROUND UPSTREAM,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 08A.
W71-05734

CONCRETE-POLYMER MATERIALS--SECOND TOPICAL REPORT,
Brookhaven National Lab., Upton, N.Y.
M. Steinberg.
BNL 50218 (T-560) and Bur Reclam Rep REC-OCE-70-1, Dec 1969. 73 p, 55 fig, 43 tab, 9 ref.

Descriptors: *Concrete technology, Concrete properties, Construction materials, Concrete additives, Concrete tests, Lightweight aggregates, Mechanical properties, *Durability, *Polymers, Radiation, Freeze-thaw durability, Catalysts, Monomers, Strength, Research and development, Impregnation, *Polymer concretes, *Polymerization, Lightweight concretes.
Identifiers: *Concrete-polymer materials.

Extended data on concrete-polymer composites as improved materials for construction are presented. The durability properties, such as freeze-thaw durability and acid and sulfate resistance, and the longer-term mechanical properties were investigated. The investigations were extended to include monomers capable of maintaining strength at elevated temperatures--thermosetting monomers such as the polyesters and epoxies, and, with the use of cross-linking agents, the thermoplastic or lower melting polymers. Measurements of mechanical properties at elevated temperatures (up to 290 deg F) are given. Special concretes (light-weight concrete containing foamed-glass aggregate and fiber-reinforced concrete) were impregnated and tested. Improvements in the structural and durability properties of concrete can be obtained by monomer impregnation and in situ polymerization by either radiation or thermal-catalytic means. (USBR)
W71-05736

8G. Materials

LOST CIRCULATION MATERIALS AND THEIR EVALUATION,
National Lead Co., Los Angeles, Calif. Baroid Div.
Robert J. White.
Spring Meeting, Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 10-11, 1956. Reprint, 10 p.

Descriptors: *Drilling fluids, Muds, *Drilling, Rotary drilling, Oil industry.
Identifiers: *Lost circulation materials, Additives, Brand names, Material use, Material function.

The function of lost circulation materials is briefly discussed. The types of materials available are listed, classified and described. The usual effective range of openings sealable is given for each type material. The type of apparatus which have been used for evaluating lost circulation materials are listed. The effect of variables in the testing method on the results obtained is discussed and typical data on several types of lost circulation material is shown. Collection and interpretation of data from laboratory evaluation tests of lost circulation materials are discussed. (Campbell-NWWA)
W71-05689

CURRENT TECHNIQUES FOR COMBATING DRILL-PIPE CORROSION,
National Lead Co., Houston, Tex. Baroid Div.
H. E. Bush.
Spring Meeting, Southwestern District, Division of Production, American Petroleum Institute, March 16-18, 1966, Hobbs, New Mexico. Reprint, 12 p.

Descriptors: *Corrosion (Pitting), *Drill pipe, *Drilling fluids, Fatigue (Mechanics), Oxidation, Rusting, Anodes, Cathodes, Oil industry.
Identifiers: *Corrosion causes, *Surface corrosion, *Hydrogen embrittlement, Corrosion inhibitors, Aerated drilling fluid.

Corrosion still plays a major role in drill pipe failures. Contaminants such as oxygen, hydrogen sulfide, sodium chloride, and carbon dioxide are commonly found in drilling fluids. Recently recognized sources of contamination are thermodegradation of mud products and inhibited stimulation additives, and these add to the corrosion problem. Physical barriers, such as scale, normally occur inside drill pipe and can result in accelerated corrosion attack. The conditions under which present drilling equipment is used increases the danger of corrosion attack from these contaminants. In recent years, test equipment has been developed and is being used to evaluate corrosion problems and mitigation techniques. Examples of techniques both in the laboratory and the field are given. Case histories of corrosion-inhibitor applications are reported. (Campbell-NWWA)
W71-05690

MASTER LIBRARY OF WATER WELL EQUIPMENT AND MAINTENANCE DATA,
National Water Well Association, Columbus, Ohio.
J. H. Lehr.
Pennsylvania, Micro-Graphix, 1970. 1104 p.

Descriptors: *Drilling equipment, *Water wells, *Mining, *Oil industry, Pumps, Screens, Coring, Drill pipe, Drill monitors.
Identifiers: *Water well equipment library, *Water well maintenance data, Auger rigs, Bits, Cable tool rigs, Down-the-hole hammer, Chlorinators, Turbines.

The National Water Well Association's Master Library contains miniature reproductions of 347 different manufacture's catalogs. Each catalog is preceded by a directory identification frame. The frame lists the manufacturer's NWWA identification number, name, address, telephone number and the name of the individual who is responsible for the sale of that manufacture's products in groundwater systems and development. The Master Library represents the most significant advancement in product information storage and retrieval ever accomplished in the groundwater industry. Through the new science of micropublishing, the NWWA has been able to compile and reproduce actual catalog presentation, of most manufactures to the groundwater industry. Each one has been cross-referenced in a comprehensive index. The contents of this library, in original size, would fill more than six filing cabinet drawers. A 7X handviewer is supplied with the Library. (Campbell-NWWA)
W71-05700

8H. Rapid Excavation

HYDRAULIC TESTING OF HOLE UAe-7h, AMCHITKA ISLAND, ALASKA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 08B.
W71-05371

8I. Fisheries Engineering

PONDFISH FARMING IN NORWAY. SURVEY OF THE SITUATION TODAY, AND AN EVALUATION OF SOME PROFITABLE FACTORS,
Leidolv Berge.
Trans from Norwegian. Available from NTIS as PB-193 923, $3.00 in paper copy, $0.95 in microfiche. Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries (Translations). Translation, Nov 1969. 121 p.
Identifiers: *Aquaculture, *Norway, *Economics, *Fresh water fishes, Fisheries, Trout, Fishing grounds, Law (Jurisprudence), Organizations, Ecology, Production, Expenses, Statistical data, Oxygen, Economic factors, Denmark, Europe, Japan, Translations, Pondfish farming.

Pondfish farming in Norway; Pondfish farming in Denmark; Production of rainbow trout in Japan; Pondfish farming in Central Europe; Environmental requirements of rainbow trout and the natural conditions for rainbow trout rearing in Norway; The pondfish industry in Norway today; Risks in the pondfish industry; Production functions; Pricing for pondfish products; Pondfish farming as subsidiary or large scale operation; and Future of pondfish farming.
W71-05669

FUNCTION OF THE CTENOID APPARATUS OF FISH IN THE PRESENCE OF A TURBULENT BOUNDARY LAYER,
V. D. Burdak.
Available from NTIS as JPRS 48838, $3.00 in paper copy, $0.95 in microfiche. Joint Publications Research Service, Washington, D.C. Translation, Sept 1969. 4 p.
Identifiers: *Fishes, *Hydrodynamics, *Turbulent boundary layer, Fishes, Scale, Laminar boundary layer, Reynolds number, Skin friction, Reduction, USSR, Ctenoid fish scales.

The hydrodynamic function of fish scale ctenoids is discussed in relation to different states of the boundary layer within the range of Reynolds numbers from 10,000 to 10,000,000. It was demonstrated that the ctenoid apparatus is capable of performing the function of a laminar in the case of both a laminar and turbulent boundary layer, with different degrees of development of turbulence in all instances, ctenoid functions are directed toward reducing the hemodynamic resistance a fish encounters as it moves.
W71-05672

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

WATER RESOURCES RESEARCH IN NEBRASKA,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Warren Viessman, Jr.
Publication No 1, July 1969. 68 p. OWRR Project A-999-NEB (1).

Descriptors: *Water resources, *Research and development, *Abstracts, *Projects, *Nebraska, Aquatic insects, Evapotranspiration, Fish, Wildlife, Flow, Groundwater, Irrigation, Legal aspects, Soil conservation, Water conservation, Soils, Plant physiology, Rivers, Engineering, Water management (Applied), Water quality, Climatology, Water utilization, Waste treatment.

This report is a collection of 80 abstracts describing research projects proposed, under way, or nearly completed, relating to water resources in Nebraska. Research projects in the following fields are abstracted: aquatic insects, evapotranspiration, fish and wildlife, fluid flow, groundwater, irrigation, law, plant science, river engineering, soil and water conservation, soils, water resources management, water quality, waste treatment, water use of plants, and weather and climate. Names and addresses of the principal investigators are listed as well as sources of funds for each project. (Yensen-Arizona)
W71-05468

WATER RESOURCES RESEARCH IN VIRGINIA - ANNUAL REPORT FOR FISCAL YEAR 1970,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.

Available from N.T.I.S. as PB-197 993, $3.00 in paper copy, $0.95 in microfiche. Virginia Polytechnic Institute and State University Water Resources Research Center Bulletin 40, December 1970. 166 p. OWRR Project A-999-VA (10).

Descriptors: *Water Resources Research Act, *Virginia, Grants, Research and development, Water resources development, Waste water treatment, Water quality, Groundwater, Hydrogeology, Water resources.
Identifiers: *Water resources research (Va).

An examination of the various water resources problems of Virginia reveals that no one dominant problem is common to all sections of the State. Therefore, the Virginia Water Resources Research Center studied the critical elements of a variety of problems hoping that this approach will provide a large return for each research dollar expended and will be of some assistance to the several areas of the State. Southeastern Virginia is experiencing a severe lowering of water tables due to excessive pumping. The establishment of water quality standards for the streams of the State pursuant to the Water Quality Act of 1965 has had a significant impact on all sections of the State. Development in some northern Virginia communities has been slowed because additional waste water hookups have been enjoined until treatment facilities are modified or improved for increasing the removal of phosphorus and nitrogen. Improved operating parameters were developed for increasing phosphorus removal in the conventional activated sludge process. Activated carbon can be regenerated by an electrochemical process which would be economical for use in small and medium size treatment facilities. The existing biological and chemical condition of the North Anna River, the proposed site of a nuclear electric plant were inventoried. Waste nylon can be used to remove phenol from water. The research results show promise for the removal of this objectionable chemical by utilizing another waste product. The impact on recreational activity of large drawdowns at multiple purpose water reservoirs is being studied. (See also W71-05556 thru W71-05558) (Knapp-USGS)
W71-05555

ANNUAL REPORT 1970.
Institute for Water Resources (Army), Alexandria, Va.
For primary bibliographic entry see Field 06B.
W71-05663

9B. Education (In-House)

CIVIL ENGINEER IN FEDERAL GOVERNMENT,
Civil Service Commission, Washington, D.C.
N. J. Oganovic.
Proc Amer Soc Civ Eng, J Prof Activ, Vol 96, No PP1, p 9-14, Sept 1970. 6 p.

Descriptors: Administration, *Management, *Federal government, *Civil engineering, *Professional personnel, Education, Engineering education, Engineering personnel, Learning, Training, Performance, Supervision, Scientific personnel objectives, *Professional development, *Civil service.
Identifiers: *Civil Service Commission, *Managerial skills, Engineers status, Career development, Careers.

An important aspect of the job of the 18,000 civil engineers in the Federal service is professionalism. A profession is defined in terms of: mental effort based on an educationally communicable body of knowledge, constant growth of the body of knowledge, dissemination of knowledge to all members, a society with professional requirements for membership, and standards of ethics and performance for all members. The various aspects of personnel management problems that the Federal Government faces in dealing with civil engineers and other professionals are: identifying jobs that require professional competence, setting appropriate qualification requirements, recruiting high-quality engineers and technicians, establishing career patterns that foster development and retention of engineers and technicians, providing training opportunities, identifying high potential for advancement, and providing for appropriate participation of professionals in employee management cooperation programs. The Civil Service Commission seeks the cooperation of civil engineers in achieving a top-notch Federal service.
W71-05737

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES RESEARCH IN NEBRASKA,
Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 09A.
W71-05468

WATER RESOURCES RESEARCH IN VIRGINIA - ANNUAL REPORT FOR FISCAL YEAR 1970,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 09A.
W71-05555

10. SCIENTIFIC AND TECHNICAL INFORMATION

STATE OF THE ART REVIEW ON SLUDGE INCINERATION PRACTICE,
Resource Engineering Associates, Wilton, Conn.
For primary bibliographic entry see Field 05D.
W71-05384

ANIMAL WASTES - A NATIONAL PROBLEM,
Cornell Univ., Ithaca. Dept. of Agriculture; and Cornell Univ., Ithaca. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-05420

WATER RESOURCES PUBLICATIONS RELATED TO THE STATE OF NEBRASKA,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Warren Viessman, Jr.
Publication No 2, October 1969. 47 p. OWRR Project A-999-NEB (2).

Descriptors: *Bibliographies, *Nebraska, *Publications, *Water resources, Seepage, Reservoirs, Rainfall, Water utilization, Electric power, Water resources development, Water pollution, Testing, Conservation, Irrigation, Surface waters, Underflow, Watersheds (Basins), Flood control, Planning, Administration, Evapotranspiration, Erosion, Legal aspects, Water distribution (Applied), Drainage, Water wells, Geology, Groundwater, Maps, Water supply, Fisheries, Recreation, Logging (Recording), Water quality, Research and development.

report is a bibliography of water resources
lications dealing with the state of Nebraska.
rly five hundred titles are listed by subject,
ering aspects of water research, administration,
ogy, management, planning, conservation, sur-
and groundwater, and water use. Many
ogic, groundwater, and irrigation maps are also
d. Dates of publication range from 1940 to
8. (Yensen-Arizona)
-05467

WATER RESOURCES RESEARCH IN NEBRASKA,
Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 09A.
W71-05468

BIBLIOGRAPHY ON COTTON IRRIGATION,
For primary bibliographic entry see Field 03F.
W71-05712

INFORMATION FOR DECISIONS IN ENVIRONMENTAL POLICY,
Library of Congress, Washington, D. C. Environmental Policy Div.
For primary bibliographic entry see Field 07B.
W71-05771

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- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Water Quality Office of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
- MANPOWER, GRANTS, AND FACILITIES
- SCIENTIFIC AND TECHNICAL INFORMATION

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JUL 30 1971

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 12
JUNE 15, 1971

W71-05836 -- W71-06455

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 12
JUNE 15, 1971

W71-05836 -- W71-06455

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency, Water Quality Office. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

GRAPHIC DISSOLVED OXYGEN COMPUTATION,
Montana State Univ., Bozeman.
Neal Dixon.
Civil Engineering, Vol 41, No 3, p 60, March 1971. 1 p, 1 fig.

Descriptors: *Dissolved oxygen, *Dissolved oxygen analyzers, Methodology, Charts, Water quality, Water analysis, Surface waters, Salinity, Atmospheric pressure, Water temperature, Dissolved solids.
Identifiers: *Dissolved oxygen nomograph.

A convenient graph for dissolved oxygen computations was devised by coupling the chart with a nomograph relating dissolved oxygen concentration, saturation concentration, percent saturation, and percent deficit. This provides a rapid means of converting dissolved oxygen concentrations in milligrams per liter to percent saturation or deficit at any altitude, temperature, and dissolved solids concentration. (Woodard-USGS)
W71-06121

1B. Aqueous Solutions and Suspensions

SODIUM, MAGNESIUM, AND CALCIUM SULFATE ION-PAIRS IN SEAWATER AT 25C,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02K.
W71-06166

EFFECT OF TEMPERATURE ON THE pH OF SEAWATER,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
For primary bibliographic entry see Field 02K.
W71-06167

02. WATER CYCLE

2A. General

MULTIVARIATE TECHNIQUES FOR SPECIFYING TREE-GROWTH AND CLIMATE RELATIONSHIPS AND FOR RECONSTRUCTING ANOMALIES IN PALEOCLIMATE,
Arizona Univ., Tucson. Tree-Ring Research Lab.; and Wisconsin Univ., Madison. Climatic Research Center; and Virginia Univ., Charlottesville. Dept. of Environmental Science.
For primary bibliographic entry see Field 02B.
W71-05851

REPORT ON BIOLOGICAL, CHEMICAL, AND GEOLOGICAL STUDIES OF BOIS BRULE AND POPLAR RIVER WATERSHEDS,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 05C.
W71-05986

PACIFIC OCEAN INFLUENCE UPON CALIFORNIA RAINFALL,
California Univ., Los Angeles. Water Resources Center.
For primary bibliographic entry see Field 02B.
W71-06115

A HYDROLOGIC ANALYSIS OF THE NEW JERSEY PINE BARRENS REGION,
Geological Survey, Trenton, N. J.
Edward C. Rhodehamel.

New Jersey Division of Water Policy and Supply Water Resources Circular No 22, 1970. 35 p, 2 fig, 2 tab, 34 ref.

Descriptors: *Water resources, *Hydrology, *Hydrologic data, *Hydrologic aspects, *New Jersey, Surface waters, Groundwater, Precipitation (Atmospheric), Runoff, Streamflow, Aquifers, Aquifer characteristics, Water yield, Water balance, Specific capacity, Hydrologic budget, Water quality, Chemical analysis, Data collections, Evapotranspiration, Geology, Vegetation, Topography.
Identifiers: *Pine Barrens region (NJ).

Resources of the Pine Barrens region of south-central New Jersey (2,250 sq. mi. region in the Atlantic Coastal Plain underlain by the Cohansey Sand) is summarized. The long-term hydrologic budget can be stated as P—R..ET where: P, the average annual precipitation is 45 inches; R, the average annual stream runoff is 22.5 inches; and ET, the average annual evapotranspiration is 22.5 inches. Average annual evapotranspiration losses which total 2.41 bgd can be divided into: (1) interception losses--0.63 bgd, (2) evapotranspiration for undrained depressions--0.09 bgd, and (3) evapotranspiration from soil and groundwater--1.69 bgd. Average annual stream runoff which totals 2.41 bgd can be divided into (1) direct runoff--0.27 bgd and (2) base runoff or groundwater runoff--2.14 bgd. The flow of water within the regional flow system is calculated to be 70 mgd, or about 0.7 inch of water per year. Both ground and surface waters contain objectionable amounts of iron and at times color, and the pH values are in the acidic range. However, because of the low concentrations of total dissolved solids (25-50 mg/liter) treatment of the water for iron removal and pH adjustments will provide a water supply suitable for most purposes. (Woodard-USGS)
W71-06125

WESTERN SNOW CONFERENCE.
For primary bibliographic entry see Field 02C.
W71-06133

LABORATORY SIMULATION OF SNOWMELT,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-06139

SIMULATING SNOWMELT HYDROGRAPHS FOR THE FRASER RIVER SYSTEM,
British Columbia Univ., Vancouver. Dept. of Civil Engineering; and British Columbia Univ., Vancouver. Water Resources Group.
A. Pipes, M. C. Quick, and S. O. Russell.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 91-97, 1970. 7 p, 4 fig, 4 ref.

Descriptors: *Simulation analysis, *Mathematical models, *Rainfall-runoff relationships, *Snowmelt, Synthetic hydrology, Evapotranspiration, Precipitation (Atmospheric), Heat budget, Topography, Temperature, Snow, Snowpacks, Streamflow forecasting, Water yield, Runoff forecasting.
Identifiers: *Runoff synthesis, Fraser River (B C).

The long term goal of a study at the University of British Columbia is to develop a simulation model of the Fraser River system for research and teaching purposes. The model can be used to estimate the consequences of storage reservoirs in the river system and simulate discharge from readily available meteorological data for purposes of flood forecasting and evaluating the impact of critical meteorological patterns. The study consists of two main phases: simulation of discharge from relatively small basins and routing of flows down the river channels. Techniques which are being used are described in the paper. (See also W71-06133) (Knapp-USGS)
W71-06147

THE AUTOMATIC HYDROLOGICAL RADIO REPORTING NETWORK, NEW ENGLAND DIVISION, CORPS OF ENGINEERS,
Office of the Chief of Engineers (Army), Washington, D.C. Civil Works Directorate.
For primary bibliographic entry see Field 07A.
W71-06149

2B. Precipitation

MULTIVARIATE TECHNIQUES FOR SPECIFYING TREE-GROWTH AND CLIMATE RELATIONSHIPS AND FOR RECONSTRUCTING ANOMALIES IN PALEOCLIMATE,
Arizona Univ., Tucson. Tree-Ring Research Lab.; and Wisconsin Univ., Madison. Climatic Research Center; and Virginia Univ., Charlottesville. Dept. of Environmental Science.
Harold C. Fritts, Terence J. Blasing, Bruce P. Hayden, and John E. Kutzbach.
Final Contract Report for Department of Commerce, Environmental Science Services Administration - Weather Bureau, November 9, 1970. 48 p, 14 fig, 2 tab, 29 ref. ESSA Contract E-41-70 (N).

Descriptors: *Dendrochronology, *Paleoclimatology, Dating, Climatology, Ecology, Forests, Growth rates, Trees, Hydrology, Hydrogeology, Statistical methods, Regression analysis, Paleohydrology.
Identifiers: *Dendroclimatology.

Ring widths from trees on certain sites reflect climatic variation. Therefore, long time series derived from replicated and precisely dated ring-width chronologies may be utilized to extend climatic records into prehistoric times. Multivariate analyses of tree-ring chronologies from western North America are used to derive response functions from which one can ascertain what climatic information each ring-width chronology contains. In addition, multivariate analyses are utilized to calibrate a large number of ring-width chronologies of diverse response functions and from widely dispersed sites with a large number of regional climatic variables. A series of transfer functions are derived which allow estimates of anomalous climatic variation from tree-ring records. Reconstructions of anomalous variation in atmospheric circulation for portions of the northern hemisphere back to A.D. 1700 are obtained by applying the transfer functions to tree-ring data for time periods when ring data are available but climatic data are not. (Knapp-USGS)
W71-05851

PACIFIC OCEAN INFLUENCE UPON CALIFORNIA RAINFALL,
California Univ., Los Angeles. Water Resources Center.
Jacob Bjerknes, and Charles B. Pyke.
Available from NTIS as PB-198 126, $3.00 in paper copy, $0.95 in microfiche. California University Water Resources Center Technical Completion Report W-254, November 30, 1970. 15 p, 10 fig. OWRR Project A-021-CAL (3).

Descriptors: *Climatology, *Synoptic analysis, Meteorology, Survey, Weather patterns, Air masses, Precipitation (Atmospheric), Storms, Weather, Rainfall.
Identifiers: *Western North America.

The climatic patterns of precipitation in the western United States and Baja California were examined in considerable detail. Of particular concern are the three prominent seasonal precipitation maxima: the winter maximum which occurs in all coastal and most interior sections, the summer maximum in the interior deserts of the southwestern United States and in Baja California, and the late spring maximum in the interior of the Pacific Northwest United States. The winter precipitation maximum is associated with extratropical cyclones of the north Pacific Ocean; and in the mean this maximum progresses generally southward along the west coast of the United States

with time, occurring in early December in northwestern Washington and in mid-February in portions of coastal southern California. This southward progression appears to be related to the general southward displacement of the mean upper tropospheric jet stream and the associated north Pacific storm track during the late fall and winter. The warm-season rainfall maxima which are observed in the interior portions of the western United States and Baja California appear to result primarily from convective activity occurring within warm, unstable air masses. (Knapp-USGS)
W71-06115

OPPORTUNITIES FOR MODIFYING WEATHER TO AUGMENT PRECIPITATION AND SUPPRESS HAIL,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 03B.
W71-06132

THE SURFACE INSTRUMENT NETWORK OF THE UPPER COLORADO RIVER PILOT PROJECT,
Western Scientific Services, Inc., Fort Collins, Colo.
For primary bibliographic entry see Field 07A.
W71-06136

THE AUTOMATIC HYDROLOGICAL RADIO REPORTING NETWORK, NEW ENGLAND DIVISION, CORPS OF ENGINEERS,
Office of the Chief of Engineers (Army), Washington, D.C. Civil Works Directorate.
For primary bibliographic entry see Field 07A.
W71-06149

DENSE NETWORK FOR RAPID MEASUREMENT OF RAINFALL RATE,
R. A. Semplak, and H. E. Keller.
Bell System Tech J, Vol 48, No 6, p 1745-1756, Jul-Aug 1969.

Descriptors: *Rain gages, *Design, *Data collections, *Rainfall disposition, *Instrumentation, *Measurement.

The design and operation of a dense rain gage system for obtaining statistical data on both the temporal and spatial distribution of heavy rainfall are discussed. This rain gage is a continuous, flow type with a response time of the order of one second. The system used for recording data on a magnetic tape is described, and typical computer-generated rain maps for large area storms and for localized showers are given.
W71-06410

2C. Snow, Ice, and Frost

FORMATION OF THE THERMAL REGIME IN SOILS ON IRRIGATED FIELDS IN PERMAFROST REGIONS,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrotekhniki i Melioratsii, Yakutsk (USSR).
For primary bibliographic entry see Field 02G.
W71-06070

WESTERN SNOW CONFERENCE.

For sale by Western Snow Conference, Mr. Robert T. Davis, Secretary, Rm. 360, United States Courthouse, Spokane, Wash. 99201 - Price $3.00. Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, 1970. 107 p.

Descriptors: *Snowpacks, *Snowmelt, *Water yield, *Data collections, *Conferences, Telemetry, Data processing, Mathematical models, Digital computers, Streamflow forecasting, Runoff forecasting, Water management (Applied).
Identifiers: *Western Snow Conference.

This publication reports the available papers and formal discussions presented at the Thirty-Eighth Annual Meeting of the Western Snow Conference. The Conference convened in Victoria, British Columbia, on April 21-23, 1970. Topics discussed include snow management, snowpack instrumentation and telemetry, simulation of snowmelt runoff, snow loads (structural), streamflow forecasting, and automated flood warnings. (See also W71-06134 thru W71-06149) (Knapp-USGS)
W71-06133

SNOW AND RESERVOIR MANAGEMENT IN CANADA FOR THE COLUMBIA RIVER TREATY OPERATION,
British Columbia Hydro and Power Authority, Vancouver, Canada, Hydrology Branch.
W. H. Fisher, and U. Sporns.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 1-6, 1970. 6 p, 3 fig, 5 ref.

Descriptors: *Reservoir operation, *International commissions, *International Joint Commission, *Columbia River, *Snow management, Runoff forecasting, Hydroelectric power, Snow surveys, Water conservation, Probability, Water storage.
Identifiers: *Columbia River Treaty.

Management of Columbia River Treaty storage reservoirs in Canada to increase hydroelectric power generation and flood control in the United States and Canada is described. Water management criteria are presented, consisting of operating rules, seasonal run-off forecasting procedures and short-term streamflow forecasting methods. The criteria, primarily derived by empirical methods, attempt to optimize the storage operation. Draft of the storage is governed by power generation requirements and seasonal run-off forecasts; refill of the storage is governed by seasonal run-off forecasts, short-term forecasts and power generation requirements. The seasonal run-off forecasts consider combined winter precipitation and snowpack water equivalent, spring and summer precipitation, antecedent precipitation and mean monthly maximum temperatures of the forecast period. Glacier melt is considered in the Mica drainage basin. (See also W71-06133) (Knapp-USGS)
W71-06134

THE DEVELOPMENT AND APPLICATION OF A HYDROLOGIC MODEL AS AN OPERATIONAL TOOL,
Sierra Hydrotechnology, Placerville, Calif., and California Cooperative Snow Surveys, Sacramento. Dept. of Water Resources.
Jack F. Hannaford, Richard H. Bush, and Raymond E. Barsch.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 7-15, 1970. 9 p, 5 fig, 1 tab.

Descriptors: *Snowmelt, *Runoff forecasting, *Mathematical models, *California, Streamflow forecasting, Rainfall-runoff relationships, Hydrograph analysis, Base flow, Recession curves, Storm runoff, Operations research, Systems analysis, Flood forecasting.
Identifiers: *Kings River (Calif), San Joaquin Valley (Calif).

A runoff simulation technique was originally prepared for use on the American River and then applied to operational problems on the Kings River watershed during the record snowmelt runoff and floods of 1969. Hydrologic concepts and processes were modeled, basic data were collected to achieve simulation of these processes, and characteristic of the watershed are described. The modelin technique was used as a management tool to pro vide basic information for making operational deci sions in the Kings River watershed during 1969 (See also W71-06133) (Knapp-USGS)
W71-06135

DENSITIES OF PRAIRIE SNOWPACKS,
Saskatchewan Univ., Saskatoon. Dept. of Agricultural Engineering; and Saskatchewan Univ. Saskatoon. Dept. of Civil Engineering.
Don M. Gray, D. I. Norum, and G. E. Dyck.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 24-30, 1970. 7 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Snowpacks, *Water equivalent, *Grasslands, *Density, *Water storage, Density stratification, Instrumentation, Nuclear moisture meters, Water yield, Snow surveys.
Identifiers: *Prairie snowpacks.

During the winters of 1968 and 1969, several studies were undertaken related to snow in the highly-exposed Prairie Environment. The average density (during December-March) of freshly-fallen snow was approximately 0.045. Freshly-fallen snow may increase in density to a value of approximately 0.23 within 24 hours after the fall of the snow. This density is approximately equal to the average density which the pack maintains during the winter months. Water equivalent estimates may be made from measured depths using an assumed density of 0.23. A two probe gamma radiation apparatus was modified so that the source and detector travel at a rate of 15 inches per minute through the snow profile. When repeated measurements of a single profile were made the mean deviation in densities for point readings throughout the profile was 0.023. The difference between the average densities for the entire pack, on repeated measurements, was approximately 0.005. Measurements made on a notched plastic block show that the system is capable of accurately detecting changes in density due to layering, if the layers are greater than 1/2 inch thick. (See also W71-06133) (Knapp-USGS)
W71-06137

LABORATORY SIMULATION OF SNOWMELT,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
Michael C. Quick.
Supported by British Columbia Disaster Relief Fund. Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 37-43, 1970. 7 p, 7 fig, 3 ref.

Descriptors: *Snowmelt, *Model studies, *Winds, *Laboratory tests, Heat budget, Turbulence, Mixing, Advection, Convection, Heat transfer, Albedo, Solar radiation.
Identifiers: *Wind tunnels, *Snowmelt simulation.

Snowmelt is the major input to high flow runoff in the Fraser River system, and it is necessary to have good understanding of factors effecting snowmelt before an adequate flow forecasting system can be constructed. To study the basic physics of snowmelt, a type of low speed wind tunnel was built in which temperature, humidity and radiation can be controlled, and melt rates of samples of snow can be measured. Results of some of these experiments are presented and the validity of such small scale tests to the calculation of, melt rates in the large scale natural situations is discussed. (See also W71-06133) (Knapp-USGS)
W71-06139

VARIATION OF GROUND SNOW LOADS IN BRITISH COLUMBIA,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.

. A. Schaerer.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 44-48, 1970. 5 p, 4 fig, 9 ef.

Descriptors: *Snowpacks, *Density, *Loads (Forces), Ice loads, Load distribution, Weight, Design, Design criteria, Building codes, Snow surveys, Data collections, Sampling, Topography, Altitude.
Identifiers: *British Columbia, *Snow loads.

he snow load used for the design of buildings vaes with geographical location, elevation and spect. In 1966 observations were initiated to obin information on the variation with elevation in ritish Columbia. This water equivalent of the ow on the ground was measured at sites having a andard exposure and at 400 feet intervals of evation on several mountains. The maximum ow load per winter is a second degree function of e elevation. Snowloads increase at a greater rate wet climate than in areas where snowfalls are all. (See also W71-06133) (Knapp-USGS)
71-06140

EVELOPMENT OF SNOW LOAD DESIGN ATA FOR THE UNITED STATES,
vironmental Data Service, Silver Spring, Md.
C. S. Thom.
oceedings 38th Annual Meeting of Western ow Conference, April 21-23, 1970, Victoria, itish Columbia, Canada: Printed by Colorado ate Univ, Fort Collins, p 49-51, 1970. 3 p, 1 fig, 8 .

scriptors: *Snowpacks, *Density, *Loads orces), Ice loads, Load distribution, Weight, sign, Design criteria, Building codes, Snow surys, Data collections, Sampling, Topography, Alude.
ntifiers: *Snow loads.

r development of snow load data for Standard A- of the U.S.A. Standards Institute, it was decided t the best basis for snow load should be observan of actual weight of snow (water equivalent) in ference to the depth of snow multiplied by the sity. Since structures must withstand the exme load in any year, the annual extreme value ribution of water equivalent on the ground is ng employed. High elevation loads are a particu- problem and work looking toward solution of problem is discussed. Results on conversion n ground to roof and the effect of roof configuon are reviewed. (See also W71-06133) (Kp-USGS)
1-06141

APPROACH TO SNOW LOAD EVALUAON,
n Webster Brown, Inc., Reno, Nev.
n Webster Brown.
ceedings 38th Annual Meeting of Western w Conference, April 21-23, 1970, Victoria, ish Columbia, Canada: Printed by Colorado e Univ, Fort Collins, p 52-60, 1970. 9 p, 4 e, 2 ref, 1 tab, append.

criptors: *Snowpacks, *Density, *Loads rces), Ice loads, Load distribution, Weight, gn, Design criteria, Building codes, Snow sur, Data collections, Sampling, Topography, Ale.
tifiers: *Snow loads.

development of the 1964 Washoe County, ada, Snow Load Code is presented. Comson is made with the 1965 National Building e of Canada, together with comments indicathe general applicability of same to other re-s. A general method of evaluating snow load es is outlined, including consideration of recure interval. Recommendations for additional courses in urbanizing mountainous areas for elation to longer term stations are set forth. also W71-06133) (Knapp-USGS)

W71-06142

SNOW LOADS FOR THE DESIGN OF ROOFS IN CANADA,
National Research Council of Canada (Ottawa). Div. of Building Research.
For primary bibliographic entry see Field 08A.
W71-06143

SNOW COURSE WEIGHTING PROCEDURE,
British Columbia Water Resources Service, Vancouver. Hydrology Div.
For primary bibliographic entry see Field 07C.
W71-06146

SIMULATING SNOWMELT HYDROGRAPHS FOR THE FRASER RIVER SYSTEM,
British Columbia Univ., Vancouver. Dept. of Civil Engineering; and British Columbia Univ., Vancouver. Water Resources Group.
For primary bibliographic entry see Field 02A.
W71-06147

SNOW SURVEY TELEMETRY NETWORKS AND FUTURE PLANS,
Soil Conservation Service, Anchorage, Alaska. Water Supply Forecasting Branch; and Soil Conservation Service, Anchorage, Alaska. Snow Survey for Alaska.
For primary bibliographic entry see Field 07A.
W71-06148

2D. Evaporation and Transpiration

ESTIMATES OF MONTHLY EVAPORATION LOSSES FROM THE GREAT LAKES 1950 TO 1968 BASED ON THE MASS TRANSFER TECHNIQUE,
Department of Transport, Toronto (Ontario). Meteorological Branch.
T. L. Richards, and J. G. Irbe.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 469-487, 1969. 19 p, 4 fig, 11 tab, 18 ref.

Descriptors: *Evaporation, *Great Lakes, *Mass transfer, Meteorology, Surveys, Water temperature, Reviews, Weather, Data collections, Meteorological data.
Identifiers: *Canada.

The Meteorological Service of Canada estimates, at the end of each month, the monthly evaporation losses from each of the Great Lakes bordering on Canada. These estimates are based on the mass transfer technique, using modified wind and vapor pressure data from shoreline climatological stations, and surface water temperature data from airborne radiation thermometer flights and ships' surveys. This paper presents a brief review of the technique and provides a record of monthly evaporation losses from each of the Lakes over a relatively long period. (See also W71-05561) (Knapp-USGS)
W71-05892

WATER CONSERVATION BY REMOVAL OF PHREATOPHYTES,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 03B.
W71-06154

2E. Streamflow and Runoff

FLAT-VEE WEIRS IN ALLUVIAL CHANNELS,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 08B.
W71-05849

EFFICIENCY OF HYDRAULIC JUMP,
Uttar Pradesh Irrigation Research Inst., Roorkee (India).
For primary bibliographic entry see Field 08B.
W71-05850

WATER RESOURCES OF THE HEBER-KAMAS-PARK CITY AREA, NORTH-CENTRAL UTAH,
Geological Survey, Salt Lake City, Utah.
C. H. Baker, Jr., and D. L. Peterson.
Utah Department of Natural Resources, Division of Water Rights, Technical Publication No 27, 1970. 79 p, 23 fig, 7 tab, 40 ref, append.

Descriptors: *Water resources, *Utah, Surface waters, Groundwater, Hydrologic budget, Streamflow, Aquifers, Water wells, Alluvium, Hydrogeology, Gravity studies, Data collections, Water quality, Hydrologic data, Hot springs.
Identifiers: Heber (Utah).

The Heber-Kamas-Park City area encompasses about 810 square miles in Wasatch and Summit Counties, in north-central Utah, and includes four mountain valleys--Heber Valley, Rhodes Valley, Parleys Park, and Round Valley--with most of the surrounding watersheds. On the boundary of the study area the average annual discharge of the Provo River for the 14-year period 1953-67 was 256,300 acre-feet per year. The average discharge of the Weber River was 110,000 acre-feet per year. The consolidated rocks of the Wasatch Range and Uinta Mountains contain large quantities of groundwater, mostly in fractures and solution openings, and numerous springs discharge water from the consolidated rocks. Most wells yield only small supplies of water from the consolidated rocks. The primary permeability of the rocks is low, and wells can produce large yields only if they intersect fractures and solution openings. Most of the wells in the area derive water from the unconsolidated alluvial fill in the four valleys. The aquifer characteristics of the unconsolidated material in the four valleys are generally similar. The transmissivity ranges from 6,700 to 20,000 cubic feet per day per foot in Heber Valley and probably is less in the other valleys. The specific yield is estimated to be 12-15 percent. In Heber Valley the average annual recharge and discharge is calculated as about 86,000 acre-feet of water. An estimated 280,000 acre-feet of water could be recovered by dewatering the upper 100 feet of the aquifer in the unconsolidated deposits in Heber Valley, 310,000 acre-feet could be recovered by dewatering the upper 100 feet in Rhodes Valley, and about 80,000 acre-feet could be recovered by dewatering the unconsolidated deposits in Parleys Park. The water is of good quality for most uses. (Knapp-USGS)
W71-05852

SUMMARY OF DATA ON TEMPERATURE OF STREAMS IN NORTH CAROLINA, 1943-67,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05855

WATER-RESOURCES APPRAISAL OF THE COLUMBUS SALT MARSH-SODA SPRING VALLEY AREA, MINERAL AND ESMERALDA COUNTIES, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W71-05862

ON UNIFORM FLOW THROUGH SMOOTH RECTANGULAR OPEN CHANNELS,
Connecticut Univ., Storrs. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 08B.
W71-05863

WATER RESOURCES OF THE BLACK RIVER BASIN, SOUTHEASTERN MICHIGAN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.

W71-05869

DIFFUSION FROM A CONTINUOUS SOURCE IN A UNIFORM SHEAR FLOW,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 05B.
W71-05872

HORIZONTAL TRANSPORT IN A ROTATING BASIN OF PARABOLIC DEPTH PROFILE,
Northwestern Univ., Evanston, Ill.
G. E. Birchfield.
Journal of Geophysical Research, Vol 72, No 24, p 6155-6163, December 15, 1967. 9 p, 3 fig, 5 ref. NSF Grant GP-3659.

Descriptors: *Rotational flow, *Flow profiles, *Surface waters, *Currents (Water), *Mathematical models, Basins, Rotations, Vortices, Eddies, Stress, Surface tension, Viscosity, Volocity, Depth, Boundaries (Surfaces), Mathematical studies, Equations, Diversion, Water circulation.
Identifiers: Horizontal transport (Water currents).

Horizontal transports in a rotating parabolic basin are found for three elementary steady stress fields. For a uniform stress, the circulation consists of two vortices so arranged that the inshore transport is more or less in the direction of the surface stress, with a return flow in the interior. For a stress with constant curl, the interior transport is a large symmetric vortex, with possibly a weak countercurrent near the shore; for a stress with constant divergence a weak vortex occurs in the interior, with weak countercurrents occurring near shore. For a combined surface stress, the transport in the interior is dominated by the curl component; near shore the uniform stress component may be equally important. (Woodard-USGS)
W71-05903

WIND-DRIVEN CURRENTS IN A LONG ROTATING CHANNEL,
Northwestern Univ., Evanston, Ill. Technological Inst.
G. E. Birchfield.
Tellus, Vol 19, No 2, p 243-249, 1967. 7 p, 1 fig, 1 tab. NSF Grant GP-3659.

Descriptors: *Currents (Water), *Surface waters, *Channel flow, *Model studies, Winds, Wind velocity, Boundaries (Surfaces), Rotational flow, Channel morphology, Stress, Water circulation, Mathematical studies, Equations, Steady flow, Surface tension, Flow profiles, Viscosity, Flow rates.
Identifiers: *Wind-driven water currents.

Boundary-layer type solutions are obtained for currents generated in a homogeneous fluid in a long rotating channel by a steady wind stress acting along or across the channel. Included are viscous wall boundary layers which arise necessarily from secondary circulations transverse to the axis of the channel, and from no-slip conditions at the wall. In order to satisfactorily incorporate the vertical structure a very simple model is used. Since the wind stress is assumed independent of the coordinate along the channel, the motions are also assumed two dimensional, with the one exception that a constant pressure gradient along the channel is permitted as a special case. The horizontal scale is such that the rotation of the channel may be taken as a constant; the fluid is homogeneous. The currents produced by the constant pressure gradient along the channel represent a counterclockwise circulation. A case of special interest is that of uniform stress along the channel. (Woodard-USGS)
W71-05904

STABILITY OF ROCK SLOPES--GRAPHICAL METHODS,
Coyne et Bellier, Paris (France).
P. Londe, G. Vigier, and R. Vormeringer
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM4, p 1411-1434, July 1970. 24 p, 14 fig, 1 tab, 9 ref, 3 append.

Descriptors: Rock mechanics, *Rocks, Sliding, *Slope stability, Soil mechanics, *Stability analysis, *Graphical analysis, Diagrams, Dams, Abutments, Computer programs, Safety factors, Shear strength, Uplift pressure, Equilibrium, Analytical techniques, Methodology, Mapping, Foreign design practices, *Rock slope stability, *In situ rock.
Identifiers: France.

Three practical procedures for constructing simple diagrams for 3-dimensional study of rock slope stability are proposed. The diagrams show simultaneously all possibilities of limit equilibrium of a tetrahedral rock volume and allow detection and appreciation of the main problems of stability. In most cases, a glance at the diagram reveals the vital parameters that should be checked by measurement or controlled by special arrangements of design. Geometrical methods (stereographic or central projection of figures drawn on a sphere) or calculations made by electronic computer can be used for diagram construction. Analysis of an arch dam abutment by diagrams constructed using each of the 3 methods is presented. (USBR)
W71-05909

EXTRAPOLATION OF HISTORICAL STORM DATA FOR ESTIMATING DESIGN-WAVE HEIGHTS,
Chevron Oil Field Research Co., La Habra, Calif.
For primary bibliographic entry see Field 07C.
W71-06123

FLOODS FROM SMALL DRAINAGE AREAS IN CALIFORNIA-A COMPILATION OF PEAK DATA OCTOBER 1958 TO SEPTEMBER 1969,
Geological Survey, Menlo Park, Calif., Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-06127

A PROPOSED STREAMFLOW-DATA PROGRAM FOR NEBRASKA,
Geological Survey, Lincoln, Neb.
For primary bibliographic entry see Field 07A.
W71-06128

THE DESCHUTES RIVER HYDROGRAPH FORECAST,
Soil Conservation Service, Portland, Oreg.
For primary bibliographic entry see Field 04A.
W71-06144

PRELIMINARY REPORT ON THE WATER RESOURCES OF THE WAILUKU AREA,
Geological Survey, Honolulu, Hawaii.
George Yamanaga, and C. J. Huxel, Jr.
Hawaii Division of Water and Land Development Circular C61, December 1970. 43 p, 9 fig, 7 tab, 9 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Hawaii, Evaluation, Hydrologic data, Data collections, Aquifers, Geology, Streamflow, Runoff, Water yield, Water quality, Aquifer characteristics, Rainfall, Water resources development, Withdrawal, Consumptive use, Specific capacity.
Identifiers: *Maui (Hawaii).

The occurrence of groundwater and surface water in the Wailuku, Hawaii area and what is known of the quantity and quality of water available for development is summarized. The area studied is about 75 square miles and is mainly the part of the Wailuki District which lies in West Maui. Drainage basins range in character from the dry gulches south of Waikapu to the deep valleys between Waikapu and Waihee. All perennial streams in the area except Makamakaole Stream derive their ba flows from water draining from high-level, dik held groundwater bodies lying within the We Maui Mountain. The largest sources of water a the Waihee River and Iao Stream. Waikapu ar Waiehu Streams also supply significant amounts water for irrigation. Groundwater occurs as hig level, dike-held water within the mountain mass, as basal water and as perched water. The mo promising source of additional water for use duri drought periods apperas to be a basla-water body the area between Waikapu and Waihee Valley (Woodard-USGS)
W71-06155

HYDROLOGIC INVENTORY OF THE UTA LAKE DRAINAGE AREA,
Utah Water Research Lab., Logan.
M. Leon Hyatt, Gaylord U. Skogerboe, Frank W. Haws, and Lloyd H. Austin.
Report PR WG 40-3, Utah Water Researc Laboratory, November 1969. 138 p. 60 fig, 43 ta 45 ref.

Descriptors: *Hydrologic data, *Hydrolog budget, *Water utilization, *Utah, *Maps, Histor Economics, Geology, Streamflow, Groundwate Water quality, Data collections, Regional analyses
Identifiers: *Utah Lake, *State water plans.

To facilitate the development of statewide plan water development for Utah, this comprehensiv report describing the Utah Lake Drainage Are was undertaken. This area, also called the Upp Jordan Hydrologic Basin is located in north-centr Utah. The physiography, topography, geology an profiles of stream beds are discussed or di grammed. Basic data are tabulated, includin precipitation, temperature, streamflow, historic runoff, principal groundwater basins, consumptiv use, water quality information, water transporta tion, and water storage. The area is divided int eighteen subareas, and water budget diagrams an analyses are presented for each subarea as well as budget for the entire area. The principal use water in the Utah Lake Drainage area is for agricu ture; and beef- and dairy-cattle production, and th raising of small grains and alfalfa, are the most im portant agricultural uses. This report is supple mented with many detailed figures and table (Yensen-Arizona)
W71-06218

HYDROLOGIC INVENTORY OF THE UINTA STUDY UNIT,
Utah Water Research Lab., Logan.
Lloyd H. Austin, and Gaylord V. Skogerboe.
Report PRWG 40-5, Utah Water Research Labora tory, March 1970. 182 p. 126 fig, 84 tab, 65 ref.

Descriptors: *Hydrologic data, *Utah, *Hydrologi budget, *Maps, *Water utilization, Regiona analyses, Data collections, Water quality, Ground water, Streamflow, Economics, Geology, History Water policy, Water resources development.
Identifiers: *Uintah Basin, *Green River, *Stat water plans.

The Uintah Basin hydrologic area is a large district in the north-eastern corner of Utah. Of grea economic importance is the oil-bearing shale of th Green River Formation. However, agriculture i the greatest water-consumer, the most importan agricultural products being beef, alfalfa, wool, an dairy products. This report was undertaken t facilitate development of a comprehensive stat water plan. The geology, history, economy, and cli mate are outlined, and the various formations af fecting groundwater flow and storage are discussed. Basic data concerning temperature precipitation, streamflow, consumptive use, and water quality are tabulated. Annual and monthly water budgets for the fifty-six subareas are presented and analyzed. Many maps, tables, and figures supplement and document this report. (Yensen-Arizona)
W71-06219

HYDROLOGIC INVENTORY OF THE WEBER RIVER STUDY UNIT,
Utah Water Research Lab., Logan.
Frank W. Haws, Roland W. Jeppson, and A. Leon Huber.
Available from Utah Water Research Laboratory, Logan, Utah $2.50. Report PRWG 40-6, Utah Water Research Laboratory, August 1970. 131 p. 37 fig, 39 tab, 56 ref.

Descriptors: *Hydrologic data, *Utah, *Hydrologic budget, *Maps, *Water utilization, Data collections, Water quality, Groundwater, Streamflow, Regional analyses, Economics, History, Geology, Water policy, Water resources development.
Identifiers: *Weber River, *State water plans.

This report was undertaken as part of an effort to compile a hydrologic inventory of the state, to be used in developing a comprehensive water plan for the state of Utah. The Weber River Study Unit is located in this area. Alfalfa, grain, corn, and orchard crops are grown. Basic features of the geology, history, economy, and climate are outlined. Information on temperature, precipitation, streamflow, water quality, and groundwater has been collected and tabulated. Monthly and annual water budgets for each of the nine subareas of this region are given and analyzed, along with a summary of the water budget program. Many figures, maps, and tables supplement this report. (Yensen-Arizona)
W71-06220

STATISTICAL SUMMARIES OF NEW JERSEY STREAMFLOW RECORDS,
Geological Survey, Trenton, N.J.
For primary bibliographic entry see Field 07C.
W71-06228

YORK RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN, VOLUME III-HYDROLOGIC ANALYSIS,
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W71-06231

SIMULATION OF RUNOFF FROM URBAN WATERSHEDS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.
W71-06306

2F. Groundwater

HYDROLOGY OF LIMESTONE TERRANES, PHOTOGEOLOGIC INVESTIGATIONS,
Geological Survey of Alabama University.
John L. Sonderegger.
Available from NTIS as PB-198 043, $3.00 in paper copy, $0.95 in microfiche. Alabama Geological Survey Bulletin 94, Part C, 1970. 27 p, 9 fig, 5 plate, 33 ref. OWRR Project B-007-ALA (4).

Descriptors: *Hydrogeology, *Remote sensing, Carbonate rocks, *Aerial photography, Alabama, Karst, Aquifers, Fractures (Geology), Surveys, Terrain analysis, Groundwater movement, Porosity, Permeability, Infrared radiation.
Identifiers: Limestone County (Ala).

Panchromatic, color, and infrared films were used to locate fracture traces as an aid to the interpretation of the occurrence and movement of groundwater in a limestone area in Alabama. Air photography using color and infrared films resulted in greater interpreter confidence and showed correlation with geologic structure. Wells drilled along fracture traces yielded substantially more water than the average of the randomly located wells. The thickness of the residuum had no noticeable control over the fracture-trace concentration. Previous models explaining the relationship between fracture traces and solution activity dealt with a single homogeneous limestone aquifer. In this area, two limestone aquifers separated by an aquiclude produce two different lithologic units on which solutional features that are reflected by fracture traces are developed. (Knapp-USGS)
W71-05838

WATER RESOURCES OF THE HEBER-KAMAS-PARK CITY AREA, NORTH-CENTRAL UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02E.
W71-05852

GROUNDWATER RESOURCES OF THE LOYSVILLE AND MIFFLINTOWN QUADRANGLES IN SOUTH-CENTRAL PENNSYLVANIA,
Geological Survey, Harrisburg, Pa. Water Resources Div.
For primary bibliographic entry see Field 04B.
W71-05853

GEOCHEMICAL SURVEY OF MISSOURI, PLANS AND PROGRESS FOR SECOND SIX-MONTH PERIOD (JANUARY-JUNE, 1970).
Geological Survey, Denver, Colo. Regional Geochemistry Branch.
For primary bibliographic entry see Field 02K.
W71-05854

WATER-RESOURCES APPRAISAL OF THE COLUMBUS SALT MARSH-SODA SPRING VALLEY AREA, MINERAL AND ESMERALDA COUNTIES, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W71-05862

WATER RESOURCES OF THE BLACK RIVER BASIN, SOUTHEASTERN MICHIGAN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05869

RECONNAISSANCE INVESTIGATION OF THE SUBSIDENCE OF VENICE AND SUGGESTED STEPS TOWARD ITS CONTROL,
Geological Survey, Sacramento, Calif.
J. F. Poland, and L. J. Mostertman.
United Nations Educational Scientific and Cultural Organization Report, Paris, 1969. 24 p, 10 fig, 1 tab.

Descriptors: *Land subsidence, *Subsidence, *Withdrawal, *Aquifers, Water levels, Reviews, Surveys, Alluvium, Coastal plains, Islands, Beaches, Groundwater, Water table.
Identifiers: *Venice (Italy).

The main cause for the recent increase of the rate of subsidence of Venice (Italy) is the withdrawal of groundwater from the aquifers in the Venetian plain. In order to investigate further the nature, rate and causes of the subsidence and in order to identify which strata contribute to this phenomenon a program of geophysical surveys and drillings, followed by field tests and laboratory analysis, is proposed. These investigations are recommended to be conducted in such a way that they also furnish data necessary for study of the feasibility of remedial measures. A system of collection of available data and the use of a mathematical model are also recommended. Immediate legislative action to control groundwater discharge is considered to be necessary. (Knapp-USGS)
W71-05870

GROUNDWATER RECONNAISSANCE OF THE GREEN RIVER BASIN, SOUTHWESTERN WYOMING,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-05902

COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
Ohio State Univ., Columbus. Water Resources Center.
George S. Taylor, and James N. Luthin.
Available from NTIS as PB-198 051, $3.00 in paper copy, $0.95 in microfiche. Ohio Water Resources Center Project Completion Report No 331X, January 12, 1971. 21 p, 4 fig, 11 ref. OWRR Project B-006-OHIO (2).

Descriptors: *Aquifers, *Drawdown, *Numerical analysis, Drainage, Zone of saturation, Hydraulic gradient, Pumping, Groundwater, Boundary processes, Wells, Seepage, Computer.
Identifiers: *Unconfined aquifer, Pumped wells, Vertical flow, Seepage surface, Free surface, Finite difference method.

The purpose is to present methods for utilizing numerical analysis and computer operations to solve problems of drawdown around a pumped well in an unconfined aquifer. The procedure is that of solving the basic flow equations for specified boundary conditions. The method takes into account the properties of the unsaturated portion of the aquifer and the contributions of vertical flow. The computer can give simultaneous solutions for flow in the saturated and unsaturated zone. The surface of seepage can also be included in the analysis. Although this report deals with flow into wells, the procedure is applicable to a variety of water flow problems. (Rackoff-Ohio State)
W71-05920

SEVENTH BIENNIAL CONFERENCE ON GROUNDWATER (PROGRESS, PRACTICE, AND POTENTIAL OF GROUNDWATER RECHARGE, DEVELOPMENT AND MANAGEMENT).
For primary bibliographic entry see Field 04B.
W71-06117

VENICE IS SINKING INTO THE SEA,
Electroconsult, Milan (Italy).
Carlo Berghinz.
Civil Engineering, Vol 41, No 3, p 67-71, March 1971. 5 p, 1 map, 3 photo, 2 tab.

Descriptors: *Land subsidence, *Submergence, *Tidal waters, *Cities, *Floods, Groundwater, Drawdown, Industries, Construction, Lagoons, Planning, Evaluation, Canals, Buildings.
Identifiers: *Venice (Italy).

Venice, Italy was founded 1,400 years ago on low land in the middle of a shallow lagoon 35 miles long and 6 miles wide. Today, storm surges of water frequently flood the low-lying city, damaging her historic buildings. What is worse, the city is subsiding, largely due to groundwater drawdown and nearby industrial construction. Sea barriers have been proposed; they would create a new problem because Venice has no sewerage system and so up to now needs the tidal flush. As interim steps, the city's artesian wells are being progressively closed, and no oil or gas drilling is permitted. Many more steps must be taken to save the city. (Woodard-USGS)
W71-06120

TURBULENT DISPERSION IN POROUS MATERIALS AS MODELED BY A MIXING CELL WITH STAGNANT ZONE,
California State Coll., Long Beach; and California Univ., Los Angeles.
C. R. Kyle, and R. L. Perrine.
Society of Petroleum Engineers Journal, Vol 11, No 1, p 57-62, March 1971. 6 p, 3 fig, 14 ref.

Descriptors: *Dispersion, *Mixing, *Porous media, *Turbulent flow, Groundwater movement, Mathematical models, Theoretical analysis, Diffusion, Turbulence.
Identifiers: *Turbulent dispersion.

A simple theoretical analysis is given of dispersion in rapid flow through porous materials. The analytical model considers a pore structure which acts like a sequence of mixing cells, each coupled with a stagnant zone. Computed results compare very favorably with experimental observations on flow through a staggered matrix of cylinders. This flow is shown to behave like packed beds of spheres with corresponding properties. Agreement requires that values for some theoretical parameters be fitted from the data. The values required for these parameters are reasonable. Development of this approach could be useful for a number of related problems. (Knapp-USGS)
W71-06122

SAFE YIELD OF AQUIFERS: AN ECONOMIC REFORMULATION,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-06126

PENETRATION IN A GRADED FILTER,
Missouri Univ., Rolla. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-06151

GEOHYDROLOGY OF THE AREA NEAR WOSCO EXPLORATORY HOLE NUMBER 1, UINTAH COUNTY, UTAH,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 08H.
W71-06153

PRELIMINARY REPORT ON THE WATER RESOURCES OF THE WAILUKU AREA,
Geological Survey, Honolulu, Hawaii.
For primary bibliographic entry see Field 02E.
W71-06155

GROUNDWATER RESOURCES OF NELSON COUNTY, NORTHEASTERN NORTH DAKOTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-06160

AVAILABILITY OF GROUNDWATER IN CHARLES COUNTY, MARYLAND,
Maryland Geological Survey, Baltimore.
Turbit H. Slaughter, E. G. Otton, and Charles P. Laughlin.
Maryland Geological Survey Bulletin 30, 1968. 100 p, 31 fig, 14 tab, 23 ref.

Descriptors: *Water resources development, *Groundwater, *Maryland, Water supply, Water yield, Water wells, Water quality, Groundwater movement, Aquifers, Urbanization, Hydrogeology, Hydrologic data, Data collections.
Identifiers: *Charles County (Md).

Charles County covers an area of 457 square miles of Maryland. On the average it receives about 46 inches of precipitation. The average annual temperature is about 56 degrees F. The estimated use of groundwater during 1962 was about 3.8 mgd. The largest single user of groundwater was the U. S. Naval Propellant Plant at Indian Head. The county is underlain by a wedge-shaped mass of sedimentary strata ranging in thickness from 600 to 2,000 feet. Several important aquifers are present throughout the county; based on rough estimates, these aquifers may be capable of yielding at least 55 mgd to properly spaced drilled and dug wells. About 3 mgd of groundwater can be obtained in the area of lowest economic and population growth potential and 16 mgd in the area of greatest potential. However, proper management of the groundwater resource will be necessary. The Waldorf area in the north-central part of the county appears to be most favorable for the development of large additional supplies. The chemical quality of the groundwater is satisfactory for most uses, although, locally, treatment for iron removal may be required. (Knapp-USGS)
W71-06168

AVAILABILITY OF GROUNDWATER IN DECATUR COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
J. W. Cagle, and W. L. Steinhilber.
Iowa Geological Survey Water Atlas No 2, 1967. 27 p, 9 fig, 3 tab.

Descriptors: *Water resources, *Groundwater, *Hydrologic data, *Data collections, *Iowa, Geology, Aquifers, Water wells, Drill holes, Water quality, Water yield, Chemical analysis, Hydrogeology, Water levels, Water sources, Pumping.
Identifiers: *Well data, *Test holes, *Decatur County (Iowa).

Groundwater information is presented to help solve the supply problems of some water users in Decatur County, Iowa. The information includes the location, definition, and estimated potential yields of the water-bearing materials in the unconsolidated deposits and the uppermost bedrock; an evaluation of the general occurrence and availability of water from bedrock sources; and a determination of the chemical quality of water from groundwater sources. Decatur County has an area of 530 sq mi and, according to the 1960 census, has a population of 10,539. About 55% of the population live on farms or in small communities where the water supply is obtained from private wells, ponds and cisterns. The remainder of the residents live in towns that have municipal water systems. Small-to-moderate supplies of water are available for development from the unconsolidated deposits in the county. Yields of several hundred gpm per well can be obtained from the deeper bedrock strata at about 2,600 to 2,700 feet in depth. Bedrock strata of shallower depths are capable of yielding 80 to 100 gpm per well. (Woodard-USGS)
W71-06175

SEEPAGE FACE EFFECTS IN UNSTEADY GROUNDWATER FLOW,
Wisconsin Univ., Madison. Water Resources Center; and Wisconsin Univ., Madison. Dept. of Civil Engineering.
Willard A. Murray.
Ph D Thesis. Wisconsin Water Resources Center, Madison, 1970. 143 p, 21 fig, 10 tab, 56 ref. OWRR Project B-021-WIS (1).

Descriptors: *Seepage, *Free surface, *Dimensional analysis, *Aquifer, *Ditches, Streams, *Flow, Water table, Drawdown, Groundwater.
Identifiers: *Saturated region, Fourier Analysis, Outflow face.

This study deals with the effect of the seepage face on the location of the free surface in a two-dimensional unconfined aquifer adjacent to a ditch or stream. The analysis is restricted to considering flow only in the saturated region below the water table; unsaturated flow effects are neglected. Theoretical solutions were obtained for steady state conditions and for the transient case of instantaneous drawdown by using potential theory and standard Fourier methods. The steady state solution is a corrected form of that presented by Kirkham (1964), which was found to contain a flaw. The transient solution involves a simple extention of the steady state solution and reduces to the latter for large time. Both solutions are presented in infinite series form. For the steady state, theoretical results indicate that the simple Dupuit parabola will give entirely satisfactory predictions of free surface locations for moderate drawdowns. For the transient case, the derived solutions indicate that the seepage face length decays exponentially. Furthermore, the transient solution including the effect of the seepage face shows a marked difference from the simplified potential solution in which the seepage face effect is neglected, particularly for small times and for locations near the outflow face. Experiments were conducted using a Hele-Shaw viscous flow model to verify the theoretical predictions.
W71-06190

WELL RECORDS, DEPTH-TO-WATER MEASUREMENTS, CHEMICAL ANALYSES OF GROUND WATER, DRILLERS LOGS, AND ELECTRIC-LOG INFORMATION IN HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS,
Geological Survey, Little Rock, Ark.
For primary bibliographic entry see Field 04B.
W71-06229

ARTIFICIAL RECHARGE PRACTICES IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 04B.
W71-06263

AN ECONOMIC ANALYSIS OF THE INTERTEMPORAL ALLOCATION OF GROUNDWATER IN THE CENTRAL OGALLALA FORMATION,
Oklahoma State Univ., Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04B.
W71-06266

2G. Water in Soils

UREA CONVERSION TO AMMONIA IN WATERLOGGED SOILS,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W71-05866

EFFECT OF FEEDLOT LAGOON WATER ON SOME PHYSICAL AND CHEMICAL PROPERTIES OF SOILS,
Kansas State Univ., Manhattan. Dept. of Agronomy, and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05C.
W71-05974

INFRARED PHOTOS CAN MAP SOILS,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 07B.
W71-06058

HOW TO SELECT AND APPLY ZINC FERTILIZER,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 03F.
W71-06059

DEGRADATION OF WATER QUALITY IN IRRIGATION RETURN FLOWS,
Robert S. Kerr Water Research Center, Ada, Okla.; and Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W71-06063

FORMATION OF THE THERMAL REGIME IN SOILS ON IRRIGATED FIELDS IN PERMAFROST REGIONS,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrotekhniki i Melioratsii, Yakutsk (USSR).
Ye. P. Galymamin.
Trans from Pochvovedenie, Vol 12, 1968. Soviet Soil Science, Vol 12, p 1623-1627. 3 tab, 2 fig, 15 ref.

Descriptors: *Permafrost, *Plant growth regulators, *Heat flow, *Soil moisture, *Soil-water-plant relationships, Regulation, Arid lands, Irrigated land, Thermal conductivity, Crop production, Growth rates, Water demand, Nutrients, Potatoes,

Vegetable crops, Stabilization, Water management (Applied), Farm management, Chernozem, Seasonal, Thawing, Temperature, Fourier analysis, Laplaces equation.
Identifiers: Field conditions, Heat-conductivity equation, Yakutsk (U.S.S.R.), U.S.S.R., Irrigation status, Irrigated crops.

Crop yields, plant growth and development are determined by thermal-, water-, and nutrient-soil regimes. Thermal-regime study is important to crops, especially in permafrost regions. Potato- and other vegetable-irrigation studies on Meadow-Chernozem soil near Yakutsk indicate that permafrost underlies a thawed layer in warm seasons. The main parameters are heat flow, thawing and temperature regime. The Fourier heat-conductivity equation is applied to field conditions. Soil moisture, or irrigation status, effect the Fourier variables. Irrigation is an effective way of regulating thermal regimes, as to provides soil moisture and temperature stability. Results of 4 other Russian studies are outlined. (Popkin - Arizona)
W71-06070

THE INFLUENCE OF VARIOUS SOIL MOISTURE-REGIMES ON THE YIELD AND QUALITY OF COTTON IN AN ARID ZONE,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 03F.
W71-06217

THE MECHANISM OF DIRECT RUNOFF FROM RAINFALL,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
James E. Garton.
Available from NTIS as PB-198 234, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Oklahoma Water Resources Research Institute, Stillwater, (1970). 20 p, 5 tab, 4 fig, 8 ref, append. OWRR Project A-006 OKLA (2).

Descriptors: *Overland flow, *Mannings equation, Uniform flow, Simulation analysis, Synthetic hydrology, *Flow resistance, Flow rates, Flow, Hydraulics.
Identifiers: *Simulated vegetation.

Information is sparse on the retardance of flow through upright stems of vegetation. Studies were conducted on a smooth flume in which cylindrical retardance elements were inserted at various regular spacings. The effects of pattern of spacing, diameter of elements, spacing of elements, slope and flow rate on Manning's coefficient were determined. Linear, quadratic and logarithmic response surfaces were calculated. Multiple correlation coefficients usually greater than 0.97 were obtained. The linear multi-variable model and the exponential model gave comparable standard deviations. A quadratic model gave slightly improved estimates, but it results in a more complex equation with eleven coefficients.
W71-06264

DEVELOPMENT OF NEUTRON ACTIVATION FOR INVESTIGATION OF WATER CLARIFICATION,
Missouri Water Resources Research Center.
For primary bibliographic entry see Field 05D.
W71-06265

PREDICTION OF MOISTURE MOVEMENT IN EXPANSIVE CLAYS,
Texas Univ., Austin. Center for Highway Research.
Robert L. Lytton, and Ramesh K. Kher.
Available from NTIS as PB-194 910, $3.00 in paper copy, $0.95 in microfiche. Research Report 117-3, May 1970. 289 p, 35 fig, 17 tab, 25 ref. OWRT supported.
Identifiers: *Clays, Soil water, *Soil water, Motion, *Partial differential equations, *Numerical integration, Computer programs, Foundations, Roads, Mathematical prediction, Permeability, Bridge foundations, GCHPIP1 computer program, Crank-Nicolson method, FLOPIP2 computer program.

This report describes two computer programs for determining changing moisture distribution with time. Program FLOPIP2 is arranged to work one-dimensional problems and computer Program GCHPIP1 solves moisture distribution problems in two dimensions. The equation governing the flow of moisture is a concentration-dependent, parabolic, partial differential equation which is solved numerically using the implicit Crank-Nicolson method of marching forward in time. Although it is stable in one-dimensional problems, the Crank-Nicolson method can become unstable in two-dimensional problems, depending upon the relative size of the components of the permeability tensor. This rare form of instability is predicted theoretically and observed in one of the example problems. Example problems are worked to demonstrate the capabilities and breadth of application of the computer programs and to prove the validity of the approach. The one-dimensional example are concerned with matching measured field data and with presenting the results of a parameter study of various suction and permeability factors. The field data can be duplicated to within very close tolerances. The two-dimensional example problems are arranged to demonstrate the versatility of computer Program GCHPIP1. Problems solved include a two-dimensional consolidation problem, ponding problems, and a problem of predicting moisture distribution within a concrete highway bridge girder.
W71-06272

BEHAVIOR OF SOIL AND FERTILIZER PHOSPHORUS IN RELATION TO WATER POLLUTION,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W71-06434

CHEMISTRY OF NITROGEN IN SOILS,
Illinois Univ., Urbana. Dept. of Agronomy; and Missouri Univ., Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W71-06436

2H. Lakes

WATER CHEMISTRY OF TOXAPHENE - ROLE OF LAKE SEDIMENTS,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05B.
W71-05840

LIMNOLOGY OF ZUNI SALT LAKE, NEW MEXICO,
Minnesota Univ., Minneapolis. Limnological Research Center.
J. P. Bradbury.
Geological Society of America Bulletin, Vol 82, No 2, p 379-398, February 1971. 20 p, 12 fig, 1 tab, 27 ref.

Descriptors: *Limnology, *Saline water, *Brines, *New Mexico, *Saline lakes, Salts, Sedimentation, Sediments, Salinity, Mixing, Thermal stratification, Density stratification, Chemical precipitation, Algae, Evaporation, Calcite, Gypsum, Water balance, Runoff.
Identifiers: Zuni Salt Lake (N Mex).

Zuni Salt Lake is a shallow saline lake in a maar in west-central New Mexico. The basin was formed during the late Pleistocene when volcanic and phreatic explosions punctured Paleozoic and Mesozoic strata. The lake is supported by runoff and saline springs (specific gravity 1.010 to 1.130), which rise along fractures in the volcanic conduits underlying the maar and apparently dissolve salt from the Permian Supai Formation. Dominant organisms of Zuni Salt Lake and the Cinder Cone Pool are Artemia salina and Hydropyrus hians. The bottom of the pool is covered with a blue-green algal mat of Anacystis sp. Sediments in Zuni Salt Lake consist of salt crusts (halite, calcite, and gypsum) inter-bedded with layers of clay and organic matter. The sediments of the pool are watery sapropel, algal material, calcite, and gypsum. Fluctuations of the chemistry, physics, and biology of these aquatic environments are extreme because of sporadic but torrential rainfall entering the shallow lakes in late summer and early fall. (Knapp-USGS)
W71-05846

THE GENERATION OF LANGMUIR CIRCULATIONS BY THE EDDY PRESSURE OF SURFACE WAVES,
Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics; and Maryland Univ., College Park. Graduate Meteorology Program.
Alan J. Faller.
Limnology and Oceanography, Vol 14, No 4, p 504-513, July 1969. 10 p, 3 fig, 12 ref. NSF Grant GA-4388.

Descriptors: *Water circulation, *Lakes, *Oceans, *Mixing, *Waves (Water), Thermal stratification, Winds, Convection, Heat transfer, Limnology, Mass transfer, Currents (Water), Model studies, Hydraulic models.
Identifiers: *Langmuir circulation.

The Langmuir circulations in lakes and oceans are shown, by theory and by the extension of laboratory experiments, to be the result of wave action. Specifically, the exponential decay of vertical oscillations that are a maximum near the free surface gives rise to an instability that is analogous to thermal convective instability but which may be two orders of magnitude or more greater than strong thermal convection. Laboratory experiments in a wind-wave tank support the predictions of the theory. Recognition of this mechanism as a primary cause of Langmuir circulations explains apparent differences between observations in lakes and oceans. (Knapp-USGS)
W71-05871

LAKE CHAMPLAIN IN RELATION TO REGIONAL WATER SUPPLY,
Vermont Univ., Burlington. Dept. of Zoology.
For primary bibliographic entry see Field 03B.
W71-05875

REMOVAL OF CONTAMINANTS FROM LAKE ONTARIO BY NATURAL PROCESSES,
Canadian Oceanographic Data Centre, Ottawa (Ontario).
For primary bibliographic entry see Field 05G.
W71-05878

INVESTIGATIONS OF DAILY VARIATIONS IN CHEMICAL BACTERIOLOGICAL AND BIOLOGICAL PARAMETERS AT TWO LAKE ONTARIO LOCATIONS NEAR TORONTO, PART I--CHEMISTRY,
Ontario Water Resources Commission, Rexdale.
For primary bibliographic entry see Field 05A.
W71-05879

TRACE ELEMENTS IN LAKE ERIE,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-05880

SURFACE WATER INPUTS OF IODINE, BROMINE, AND CHLORINE TO LAKE HURON,
Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography; and Michigan Univ., Ann Arbor. Great Lakes Research Div.

For primary bibliographic entry see Field 05B.
W71-05882

A FIELD STUDY OF LANGMUIR CIRCULATIONS,
State Univ. of New York, Albany.
Glenn E. Myer.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 652-663, 1969. 12 p, 11 fig, 1 tab, 21 ref.

Descriptors: *Water circulation, *Lakes, *New York, *Thermal stratification, *Stratified flow, Currents (Water), Mixing, Heat transfer, Diffusion, Convection.
Identifiers: *Langmuir circulation.

To determine the thermal structure and importance of Langmuir circulations, floating temperature probes were used in Lake George, N. Y. Under thermally stable conditions Langmuir circulations transport heat downward. Langmuir circulations are a major cause of epilimnion mixing and thermocline development and decline in lakes. The Langmuir circulations appear to be coupled to the wind by some indirect mechanism. The mechanisms for this coupling which best fit field observations on Lake George are those acting as or very near the water surface. (See also W71-05561) (Knapp-USGS)
W71-05884

SUMMER THERMAL STRUCTURE AND CIRCULATION OF CHEQUAMEGON BAY, LAKE SUPERIOR--A FLUCTUATING SYSTEM,
Wisconsin Univ., Madison. Marine Studies Center.
R. A. Ragotzkie, W. F. Ahrnsbrak, and A. Synowiec.
Supported by a grant from the E. J. du Pont de Nemours and Company. In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 686-704, 1969. 19 p, 13 fig, 4 tab, 10 ref.

Descriptors: *Water circulation, *Bays, *Lake Superior, *Thermal stratification, *Currents (Water), Great Lakes, Seiches, Wisconsin, Limnology, Waves (Water), Winds, Surveys, Current meters.
Identifiers: *Chequamegon Bay (Lake Superior).

An extensive series of measurements of thermal structure, currents and seiches was made during July and August 1968 on Chequamegon Bay, a semi-enclosed bay of Lake Superior. Analysis of these data shows that the circulation of this bay is a fluctuating system in which water movement associated with wind-induced movements of the thermocline is the primary mechanism for water exchange between the Bay and the Lake. Superimposed on this flushing mechanism is a complex pattern of temporally and spatially varying currents associated with seiche activity in the Bay. Current measurements also suggest a weak anticlockwise general circulation. It is postulated that the physical behavior of Chequamegon Bay and its interaction with Lake Superior may be characteristic of other semi-enclosed bays of the Great Lakes. (See also W71-05561) (Knapp-USGS)
W71-05885

BOTTOM SEDIMENT SAMPLING,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters
For primary bibliographic entry see Field 07B.
W71-05886

GEOCHEMICAL SYSTEMS IN ONONDAGA LAKE (CENTRAL NEW YORK STATE) COMPARED WITH THE GREAT LAKES,
Slippery Rock State College, Pa. Dept. of Geology.
Jeffrey C. Sutherland.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 357-363, 1969. 7 p, 6 fig, 18 ref. FWQA Grant WPRD 66-01-68.

Descriptors: *Water chemistry, *Clay minerals, *Lakes, Silica, Calcium, Sodium Chlorides, Phosphates, Lake Huron, Lake Erie, Great Lakes, Equilibrium, Aqueous solutions, Ion exchange, Carbonates, Kaolinite, Montmorillonite.
Identifiers: Onondaga Lake (NY).

Onondaga Lake is shallow, eutrophic, and contains unusually high concentrations of dissolved Ca, Na, Cl, SiO_2, and PO_4. Interpretations of chemical and mineralogical data tested in equilibrium models are compared with those for the Great Lakes. The average annual condition of near equilibrium with calcite and dolomite is inherited from influent streams. Lake Erie is in equilibrium with hydroxyapatite, but Onondaga Lake is oversaturated, approaching equilibrium in winter only. Whereas lower limits of silica in the North Channel and Lake Huron are probably established through dissolution of kaolinite, upper limits upon silica in Onondaga Lake may partly be a function of reaction of kaolinite to form K feldspar. Concentrations of silica in sediment-enclosed waters of the North Channel and Onondaga Lake approach equilibrium values with amorphous silica. Equilibrium between montmorillonite and kaolinite may depend upon ratios of calcium to sodium, among other factors: In carborate mineral-bearing Great Lakes sediments kaolinite approaches equilibrium with Ca montmorillonite, but in Onondaga Lake approach to equilibrium with Na montmorillonite is inferred. (See also W71-05561) (Knapp-USGS)
W71-05888

THE QUALITATIVE DISTRIBUTION OF FELDSPARS IN SURFICIAL BOTTOM SEDIMENTS FROM LAKE ONTARIO,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 02J.
W71-05889

GEOLOGICAL, CHEMICAL, AND PHYSICAL ATTRIBUTES OF SEDIMENTS IN SENECA LAKE, NEW YORK,
Hobart Coll., Geneva, N.Y.; and Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
For primary bibliographic entry see Field 02J.
W71-05890

WIND INDUCED CIRCULATION PATTERN IN A ROTATING MODEL OF LAKE ERIE,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
Peter J. Buechi, and Ralph R. Rumer.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 406-414, 1969. 9 p, 10 fig, 8 ref. FWQA Grant WP-00837.

Descriptors: *Water circulation, *Lake Erie, *Currents (Water), Winds, Waves (Water), Seiches, Distribution patterns, Model studies, Hydraulic models, Hydraulic similitude, Flow, Great Lakes.
Identifiers: Lake circulation.

Experimental studies to determine the effects of a prevailing westerly wind on the circulation patterns in a vertically distorted Froude model of Lake Erie were performed in a rotating laboratory that housed the model lake, all necessary instrumentation, and personnel. A vertical scale of 1:500 and a horizontal scale of 1:200,000 were used. Wind stresses were simulated using a battery of blowers. Model wind velocities could be varied from zero to 13 ft/sec. Preliminary correlation with prototype wind speeds was obtained by measuring water level changes in the eastern end of the model lake and comparing with available prototype field observations for known wind conditions. Motion picture studies with dyes serving as tracers were used in the collection of data. Comparison with earlier circulation studies performed in the absence of wind stress reveals significant changes in the overall circulation pattern and the appearance of significant differences between surface and subsurface circulation patterns. (See also W71-05561) (Knapp-USGS)
W71-05891

ESTIMATES OF MONTHLY EVAPORATION LOSSES FROM THE GREAT LAKES 1950 TO 1968 BASED ON THE MASS TRANSFER TECHNIQUE,
Department of Transport, Toronto (Ontario). Meteorological Branch.
For primary bibliographic entry see Field 02D.
W71-05892

STATISTICAL ANALYSIS OF CURRENTS AT TWO NEAR-BY STATIONS IN LAKE MICHIGAN, SUMMER, 1967,
Northwestern Univ., Evanston, Ill. Dept. of Engineering Sciences; and Michigan Univ., Ann Arbor. Great Lakes Research Div.
G. E. Birchfield, and V. E. Noble.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 529-539, 1969. 11 p, 8 fig, 4 ref.

Descriptors: *Currents (Water), *Water circulation, *Lake Michigan, Sampling, Correlation analysis, Current meters, Tracking techniques, Gaging stations, Weather, Winds, Waves (Water), Great Lakes.
Identifiers: Lake currents.

Two anchored buoy stations were placed 8 mi off Sheboygan, Wisconsin, 1/2 mi apart, in approximately 100 m of water. Observations of currents at 5-min intervals near the surface and 10 m were made for about 8 days. Repeated measurements of currents using drogues were made during the interval; in addition dynamic height currents were estimated from BT soundings made in the vicinity of the stations. For motions of time-scale larger than 10-12 hr, the current meter data were closely correlated with one another. For shorter period motions the current meter data were seriously distorted. Drogue measurements were fairly consistent with the current meters, but tended to show more consistency among themselves. Dynamic height currents proved inadequate. The complexity of coastal currents is illustrated with the example of currents associated with two cold-frontal passages over the Lake. (See also W71-05561) (Knapp-USGS)
W71-05893

WAVE FORCES IN LAKE ERIE,
Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
Alan L. Cole.
Supported by US Lake Survey, Army Corps of Engineers. In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 540-552, 1969. 13 p, 11 fig, 2 tab, 2 ref.

Descriptors: *Waves (Water), *Lake Erie, *Energy, *Coastal engineering, Great Lakes, Erosion, Shore protection, Data collections, Surges, Shores, Harbors, Pressure.
Identifiers: *Wave forces (Lake Erie).

Direct measurement of the pressure of Great Lakes' waves on a breakwater in Lake Erie at Lorain, Ohio was undertaken to produce data to be used in an evaluation of the applicability of existing theories to Great Lakes conditions and to provide

empirical relationships for breakwater design, ship design, and other practical needs in the Great Lakes. The East Breakwater Shorearm at Lorain, Ohio was chosen to be instrumented because of its location, orientation, type of construction and ownership. The field project was initiated in September, 1968 and was terminated by ice conditions in December, 1968, with data taken in November and December, 1968. Wave pressure decreases below the still water level as predicted by Sainflou. (See also W71-05561) (Knapp-USGS)
W71-05894

SMALL-SCALE MODEL OF THE 'THERMAL BAR',
British Columbia Univ., Vancouver. Inst. of Oceanography.
G. H. Elliott, and J. A. Elliott.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 553-557, 1969. 5 p, 3 fig, 6 ref.

Descriptors: *Thermal stratification, *Great Lakes, Stratified flow, Water circulation, Currents (Water), Water temperature, Thermocline, Limnology.
Identifiers: *Thermal bar (Great Lakes), Thermal plumes.

A two-dimensional freshwater model was used to simulate the 'thermal bar' phenomenon by heating and cooling the water through 4C. The temperature profiles were similar to observations made in the Great Lakes. The current patterns observed suggest that the 'thermal bar' is actually a thermal plume with an overriding wedge of stable water. (See also W71-05561) (Knapp-USGS)
W71-05895

INTERNAL WAVES OF THE SECOND VERTICAL MODE IN LAKE HURON,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
Alan M. Hale.
Supported by the Great Lakes Inst., Univ. of Toronto. In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 564-566, 1969. 3 p, 3 fig, 5 ref.

Descriptors: *Waves (Water), *Stratification, *Stratified flow, *Lakes, Great Lakes, Mathematical studies, Model studies, Interfaces, Density stratification, Currents (Water), Thermal stratification.
Identifiers: *Internal waves (Lakes).

A two-layer model is often used for the theoretical analysis of internal waves in a body of stratified fluid. Only a single mode of motion, a 'simple' oscillation of the interface (an internal wave of the first vertical mode) is predicted by this modelling. Because natural fluid bodies have a continuous density variation, corresponding theoretical analyses allow other modes of motion. One of the possible modes may be described as a pulsation of the fluid between isothermal surfaces and is called an internal wave of the second vertical mode. Experimental evidence supporting the existence of internal waves of the second vertical mode is presented. (See also W71-05561). (Knapp-USGS)
W71-05896

HYDRAULIC AND WIND-INDUCED CIRCULATION IN A MODEL OF A GREAT LAKE,
Department of Energy, Mines and Resources, Burlington (Ontario). Great Lakes Div.
J. F. Hamblin.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 567-582, 1969. 16 p, 7 fig, 10 ref.

Descriptors: *Water circulation, *Great Lakes, *Currents (Water), *Winds, Model studies, Mathematical studies, Flow, Thermal stratification, Lakes, Stratified flow, Mathematical models.
Identifiers: Wind-induced curculation (Great Lakes).

The steady state hydraulically induced circulation of a rotating lake of circular plan was studied by means of numerical solutions of the equations of fluid motion. Frictional dissipation is assumed to be accounted for by constant lateral and vertical eddy diffusivities. In a homogeneous lake of uniform depth, the circulation consists of a diffuse flow from source to sink throughout the lake. For a parabolic basin, the flow is divided into two unequal streams, each following the shoreline and having a width of approximately 10 km. Circulation due to a uniform windstress directed along a diagonal of the basin of variable depth from source to sink obscures the underlying hydraulic circulation. When two-layer stratification is taken into account, the steady state hydraulically driven circulation undergoes a marked alteration. Hydraulic flow in the upper layer assumes a configuration similar to that of the homogeneous lake of constant depth. Windstress applied to the upper layer from the source to the sink has the effect of concentrating the hydraulic circulation in a narrow stream along the shoreline of the lake to the right of the direction of flow. (See also W71-05561). (Knapp-USGS)
W71-05897

SOME UNUSUAL SURFACE WATER TEMPERATURE PATTERNS IN THE GREAT LAKES, AS DETECTED BY AIRBORNE RADIATION THERMOMETER SURVEYS,
Meteorological Service of Canada, Toronto (Ontario).
For primary bibliographic entry see Field 07B.
W71-05898

VISUAL WAVE OBSERVATIONS ALONG THE LAKE MICHIGAN SHORE,
United States Lake Survey, Detroit, Mich.
Paul C. Liu, and John G. Housley.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Micigan, Ann Arbor: International Association for Great Lakes Research, p 608-621, 1969. 14 p, 12 fig, 7 tab, 5 ref.

Descriptors: *Waves (Water), *Lake Michigan, *Data collections, Great Lakes, Fetch, Frequency, Wavelengths, Monitoring, On-site data collections, Storms, Winds, Statistics.
Identifiers: U. S. Coast Guard.

A program of visual observations of lake waves along the Lake Michigan shore was conducted during the autumns of 1966 and 1967. Observers at seven Coast Guard stations participated in this program. Observations were made from shore at each station at 4-hr intervals during the periods when small craft or storm warnings were displayed and included wave height, wave period, and direction of wave approach. The majority of wave heights observed along the Lake Michigan shore during the storm conditions were of the order of 1 m, and have periods were mostly between 3 and 7 sec. While higher wave heights were reported in the northern part of the Lake, the stations in the southern part tended to report longer wave periods. An average of 20% of waves observed on the east shore and 7% of the waves observed on the west shore were over 2 m in height. A study of the joint distributions of observed wave height and wave period indicated that the steepnesses of waves were generally quite high sometimes even exceeding 1:10. (See also W71-05561). (Knapp-USGS)
W71-05899

DIURNAL CHANGES IN STRATIFICATION AND DISSOLVED OXYGEN IN THE SURFACE WATERS OF LAKE MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Botany; and North Carolina Univ., Chapel Hill. Dept. of Zoology.
Bruce A. Manny, and Charles A. S. Hall.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 622-634, 1969. 13 p, 7 fig, 2 tab, 35 ref.

Descriptors: *Dissolved oxygen, *Thermal stratification, *Lake Michigan, *Diurnal distribution, Respiration, Photosynthetic oxygen, Algae, Plankton, Limnology, Great Lakes, Water circulation, Mixing, Data collections, Primary productivity.
Identifiers: Diurnal DO changes.

First estimates of gross community production (23.7 g of 02 per sq m per day) and respiration (26.4 g of 02 per sq m per day) for Lake Michigan were obtained by the diurnal oxygen curve method at two inshore stations off Grand Haven, Michigan during a period of high plankton densities. Diurnal temperature changes of more than 3 deg C in the upper epilimnion resulted in partial breakdown of epilimnetic stratification leading to establishment of nocturnal isothermy. Such marked diurnal changes should be considered when interpreting surface and epilimnetic temperatures between stations because the magnitude of diurnal temperature variation may exceed station to station variability. Effects of wind mixing, internal standing waves and lateral and vertical transport appeared in the data and are discussed. Although these factors could not be neglected in Lake Michigan, the diurnal oxygen curve method performed adequately and warrants further trials on the Great Lakes. (See also W71-05561). (Knapp-USGS)
W71-05900

LARGE-SCALE DIFFUSION STUDIES AT NIAGARA RIVER MOUTH, LAKE ONTARIO,
Canada Center for Inland Waters. Department of Energy, Mines and Resources, Burlington (Ontario).
For primary bibliographic entry see Field 07B.
W71-05901

DISTRIBUTION OF TRACE METALS IN IMPOUNDMENTS,
Arkansas Univ., Fayetteville Resources Research Center.
For primary bibliographic entry see Field 05B.
W71-05971

ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
State Univ., of New York, Albany. Dept. of Earth and Atmospheric Sciences.
Jon T. Scott, Glenn E. Myer, Ronald Stewart, and Eric G. Walther.
Limnology and Oceanography, Vol 14, No 4, p 493-503, July 1969. 11 p, 11 fig, 27 ref. OWRR Project B-015 NY (2).

Descriptors: *Water circulation, *Mixing, *Lakes, *Thermal stratification, New York, Winds, Convection, Epilimnion, Heat transfer, Limnology, Mass transfer, Currents (Water), Solar radiation, Waves (Water).
Identifiers: *Langmuir circulation, Lake George (NY).

Six mechanisms have so far been proposed to explain Langmuir circulations and their associated wind streaks. One mechanism involving shearing instability and two requiring the action of a surface film are supported by the greatest amount of evidence. Studies at Lake George, New York, suggest that more than one mechanism may operate at one location. A particular mechanism may operate at a specific site because of typical conditions at the site, but a different mechanism may be more important at another site. Plots of thermal structure in the near-surface layer of Lake George and measurements of vertical current velocities suggest that Langmuir circulations are the most important mixing process in the epilimnia of lakes. (See also W71-05561) (Knapp-USGS)
W71-05975

JULY CURRENTS NEAR THE SOUTH SHORE OF LAKE ONTARIO,
State Univ. of New York, Albany. Dept. of Atmospheric Sciences.
Jon T. Scott, and Dennis R. Landsberg.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 705-722, 1969. 18 p, 16 fig, 4 tab, 19 ref. OWRR Project B-015 NY (1).

Descriptors: *Water circulation, *Currents (Water), *Lake Ontario, Great Lakes, Current meters, Jets, Waves (Water), Stratified flow, Winds, New York, Water temperature.
Identifiers: *Geostrophic flow.

Drogue measurements of current speed and direction at five anchored buoys near the south shore of Lake Ontario from 11 to 20 July 1968 near Fairhaven, N.Y., showed that total transport in the 35 m layer was northeastward along the shore. However, at stations 1 and 2 km from shore there was a southwestward flowing 'countercurrent.' The maximum northeastward 'coastal jet' was computed from daily temperature soundings at 10 stations. Internal waves and wind fluctuations did not mask the baroclinic geostrophic flow for this nearshore case. Baroclinic geostrophic flow and total transport were to the northeast in the surface layers, but the analysis indicated there was a slow return flow opposed to these. Transport in deep water was, therefore, southwestward. The baroclinic geostrophic computation is a good predictor of surface currents in summer when the latter are much larger than the steady return barotropic flow. (See also W71-05561) (Knapp-USGS)
W71-05978

CONDITIONS AFFECTING THE REDUCTION OF IRON AND MANGANESE BY BACTERIA IN THE ORE-BEARING LAKES OF THE KARELIAN ISTHMUS,
Akademiya Nauk SSSR, Leningrad. Institut Tsitologii.
For primary bibliographic entry see Field 02K.
W71-05993

PRIMARY PRODUCTION AND CHEMICAL AND PHYSICAL CHARACTERISTICS OF LAKE ASHTABULA RESERVOIR, NORTH DAKOTA,
North Dakota State Univ., Fargo. Div. of Natural Resources.
John J. Peterka, and Leonard A. Reid.
Proceedings of the North Dakota Academy of Science, Vol 22, p 138-156, 1968. 7 fig, 4 tab, 19 ref.

Descriptors: *Lakes, *Primary productivity, *Chemical properties, *Physical properties, Reservoirs, Sampling, Phytoplankton, Analytical techniques, Temperature, Chlorophyll, Hydrogen ion concentration, Alkalinity, Phosphorus, Nitrates, Nitrites, Ammonia, Dissolved solids, Biochemical oxygen demand, Photosynthesis, Eutrophication, North Dakota.
Identifiers: *Lake Ashtabula (ND), Self-inhibition.

This study of Lake Ashtabula Reservoir, ND recorded from May to December the average phytoplankton crop as 101 g/sq m of chlorophyll a, corresponding to dry organic matter content of 121 kg/ha. The average gross photosynthesis during the same period was 2 2 g C/sq m per day. The almost continual bloom of algae is attributed to warm water and prolonged water circulation. The limited oxygen production per unit of chlorophyll may have been caused by the heavy blooms with photosynthetically inactive cells, or photosynthesis-inhibiting substance produced by the phytoplankton. Regression analysis failed to indicate any significant relationship of productivity with the contents of N and P, suggesting a possibility of an influence of some other nutrient element limiting the photosynthesis. (Wilde Wisconsin)
W71-06098

THE EFFECTS OF THERMAL DISCHARGES ON THE STRATIFICATION CYCLE OF LAKES,
Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
For primary bibliographic entry see Field 05C.
W71-06082

THE MIXING OF A SHALLOW SUBMERGED HEATED WATER JET WITH AN AMBIENT RESERVOIR,
Maryland Univ., College Park. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 05C.
W71-06084

VERTICAL DIFFUSIVITY COEFFICIENT IN A THERMOCLINE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
H. E. Sweers.
Limnology and Oceanography, Vol 15, No 2, p 273-280, March 1970. 3 fig, 1 tab, 7 ref.

Descriptors: *Thermal pollution, *Thermocline, Temperature, Depth, Isotherms, Lake Ontario.
Identifiers: *Vertical diffusivity coefficient, Lake mean heat content.

Two equations are presented giving the vertical eddy diffusivity coefficient, Kz, in the thermocline of a well-stratified lake as a function of its mean rate of downward displacement and intensity. Both equations are derived by transforming the heat transport equation into a quasi-Lagrangian coordinate system, the origin of which moves down with the lake mean thermocline depth. These equations can only be used to give analytical description of the downward movement of the thermocline in general terms. They cannot be used to describe the actual physical processes causing this movement nor even the changes in thermocline depth over short time intervals or in small fraction of the lake. Applications of the equations to Lake Ontario yields summer mean values of Kz in the thermocline of 0.02 to 0.07 cm sq per sec. During an exceptionally quiet period in July and August, 1967, Kz approached the value of molecular diffusivity, 0.0012 cm sq/sec. The vertical diffusivity of heat in and below the thermocline is smaller than the vertical diffusion in epilimnion. Therefore, the thermocline acts as a barrier to downward convection of heat. (Upadhyaya-Vanderbilt)
W71-06088

COLORADO SEMIDRAINAGE MOUNTAIN LAKES,
Colorado Univ., Boulder. Dept. of Biology.
Robert W. Pennak.
Limnology and Oceanography, Vol 14, No 5, p 720-725, September 1969. 6 p, 1 fig, 1 tab, 15 ref.

Descriptors: *Limnology, *Colorado, Mountains, Nitrates, Organic matter, Biological properties, Nutrients, Runoff, Overland flow, Seepage, Surface-groundwater relationships, Eutrophication.
Identifiers: Semidrainage lakes.

A distinctive semidrainage lake type is common at midmountain elevation in Colorado. Such lakes are similar in their small size, shallow depth, lack of an outlet, high nitrate content, high organic content, and high water color. 'Indicator species' are Rana pipiens, neotenic Ambystoma tigrinum, Gammarus limnaeus, an association of three leeches (Nephelopsis obscura, Glossiphonia complanata, and Helobdella stagnalis), and Nuphar polysepalum. Usually 8 to 14 species of rooted aquatics are present by late summer. Sponges are abundant, fish are absent, and plankton is sparse. Evidence is presented to show that semidrainage lakes are limnoseres. (Knapp-USGS)
W71-06165

A CASE STUDY OF COASTAL CURRENTS IN LAKE MICHIGAN,
Northwestern Univ., Evanston, Ill. Technological Inst.
G. E. Birchfield, and Daniel R. Davidson.
Proceedings, Tenth Conference on Great Lakes Research, Toronto, Canada, 1967: International Association for Great Lakes Research, p 264-273, 1967. 10 p, 7 fig, 11 ref.

Descriptors: *Currents (Water), *Lake Michigan, *Winds, *Current meters, *Statistical methods, On-site investigations, Eddies, Flow rates, Movement, Wind velocity, Temperature, Water circulation, Costs, Methodology, Stations, Climatology
Identifiers: *Statistical analysis (Winds and currents).

A statistical study of winds and currents is made for two adjacent buoy stations near shore in the southern basin of Lake Michigan for the late summer and autumn of 1963. Weekly mean currents and vector variances, 18-hour mean currents and transports, variance and covariance spectra are calculated for the episode. A broad southerly long shore baroclinic coastal current persisted for a number of weeks in the first part of the episode; the current shows no correlation with the wind direction, and little with the wind speed. In the latter part of the episode maximum speeds are associated with a more narrow inshore, barotropic coastal current, which is closely correlated with the wind field. The currents at the station farthest offshore exhibit very large amplitude oscillations near the inertial period, in the first part of the episode studied. (Woodard-USGS)
W71-06174

SELECTIVE WITHDRAWAL AT LAKE LIVINGSTON, PRELIMINARY EVALUATIONS, 1969,
Texas Univ., Austin. Center for Research in Water Resources.
For primary bibliographic entry see Field 05C.
W71-06193

REGENERATION OF THE SEVAN,
Army Foreign Science and Technology Center, Charlottesville, Va.
V. Kadzhaya.
Available from NTIS as AD-715 367, $3.00 in paper copy, $0.95 in microfiche. Translated from: Nauka i Zhizn; No 3, p 60-64, 1970. Technical Translation FSTC-HT-23-1103-70, October 1970. 10 p, 6 fig.
Identifiers: *Lakes, Water supplies, *Inland waterways, Construction, Power plants, Establishments, Volume, Economics, Electric power production, USSR, Translations, *Lake Sevan, Arpa-Seven Canal, *Lake restoration.

Beginning in the 1930's the Lake Sevan was constantly reduced in size in order to supply water for the needs of hydroelectric power stations. As a result, the volume and area of the lake constantly decreased. This plan for sacrificing Lake Seven for the needs of the national economy could only continue for a period of about 50 years. Fortunately, at the end of the 50 years other conditions had arisen which have made it possible to begin work on the restoration of Lake Sevan. This article describes some of the measures which are being taken for this purpose. Emphasis is on construction of the Arpa-Sevan canal. The article is of interest to those concerned with Russian Hydroelectric Power.
W71-06330

EFFECTS OF AGRICULTURAL POLLUTION ON EUTROPHICATION,
Wisconsin Univ., Madison. Dept. of Sanitary Engineering, and Wisconsin Univ., Madison. Dept. of Water Chemistry.
For primary bibliographic entry see Field 05C.
W71-06443

2I. Water in Plants

A STUDY OF RELATIONSHIPS BETWEEN ZOOPLANKTON ABUNDANCE AND SELECTED ENVIRONMENTAL VARIABLES IN

THE PAMLICO RIVER ESTUARY OF EASTERN NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept of Zoology.
David S. Peters.
MS thesis, Dep of Zoology, North Carolina State Univ, 1968. 38 p, 4 fig, 6 tab, 50 ref. OWRR Project B-0040NC (6).

Descriptors: *Zooplankton, *Estuaries, *Copepods, Light intensity, Environmental effects, Temperature, Salinity, Turbidity, Chlorophyll, North Carolina.
Identifiers: *Pamlico River Estuary (NC), Harpoticoid copepods, Calanoid copepods, Chlorophyll-a.

The relationship between the abundance of zooplankton and environmental variables was studied from October 1965 to July 1967 in the Pamlico River estuary, N. C. The distribution of harpacticoid copepods was regulated by light, few organisms being present in the water column during the day; their increased concentration at night may have been partly due to wind-mixing. The calanoid copepods were the most frequent constituents of the estuary zooplankton. According to the results of multiple regression, their abundance was related to salinity, temperature, oxygen concentration, turbidity, light intensity, and food supply provided by phytoplankton and detritus. Temperature was particularly important in the lower part of the river, whereas oxygen concentration--in the upstream. (Wilde-Wisconsin)
W71-05985

ENVIRONMENTALLY-INDUCED CHANGES IN THE FATTY ACIDS OF CHLORELLA,
Maryland Univ., College Park. Dept. of Botany.
Neal G. Dickson, Raymond A. Galloway, and Glenn W. Patterson.
Plant Physiology, Vol 44, p 1413-1416, 1969. 3 tab, 17 ref. NIH Grant T01G M0097603.

Descriptors: *Algae, *Carbon dioxide, *Environmental effects, *Chlorella, Analysis, Cultures, Lipids, Metabolism, Inhibitors.
Identifiers: *Fatty acids, Chlorella fusca, Palmitic acid, Cell division, Heterotrophic culture, Autotrophic culture.

An initial investigation of why and how Chlorella accumulates fatty acids was made. Qualitative and quantitative analyses were performed on the major fatty acids of Chlorella fusca, Shihira and Krauss, in both autotrophic and heterotrophic cultures. Cells grown heterotrophically were subjected to carbon dioxide concentrations as great as 40%-in-air. The major fatty acids of autotrophic cells grown under a 1% environmental concentration of carbon dioxide, in order of concentration were 16:0, 18:3, 16:4, 18:2, 18:1 and 16:3. Analysis of heterotrophic cells at 1% carbon dioxide, by comparison, indicated a complete absence of 16:4, reduced amount of 18:3, and increased amounts of the other major acids. An increase in the environmental concentration of carbon dioxide (from 1-10%) over the heterotrophic cultures produced a 10% increase in total lipids and nearly a 50% increase in fatty acids. Palmitic acid (16:0) and 18:1 largely account for the fatty acid change by increasing from 12 mg to 33 mg/g dry weight and 8 mg to 17 mg/g dry weight respectively. Possible explanations for this enhanced synthesis of fatty acids are suggested. (Jones-Wisconsin)
W71-05992

ALGAL TOXINS,
New Hampshire Univ., Durham. Dept. of Zoology.
Yoshi Ikawa.
Summary of 1970 University of New Hampshire Faculty Sigma Xi Lecture delivered November 19, 1970 at Durham, New Hampshire. 4 p. OWRR Projects A-004-NH (5) and A-013-NH (3).

Descriptors: *Algal toxins, Dinoflagellates, Chrysophyta, Cyanophyta, Mortality, Inhibitors, Antibiotics (Pesticides), Red tide.
Identifiers: *Biotoxins, Ciguatoxin, Mycrocysten, Saxitoxin, Tetrodotoxin, Paralytic shellfish poisoning, Antibiotics, Acetylcholine.

Recent research identified biotoxins, including extremely potent saxitoxin and tetrodotoxin, emitted by marine and fresh water algae, predominantly dinoflagellates, chrysophytes, and blue-green species. Paralytic shellfish poisoning (PSP), fish kills, and death of birds, livestock, dogs, and even human beings are among the direct or food chain consequences. Gonyaulax catanella, Gymnodinium breve, G tamarensis, Pyrodinium phoneus, Microcystis aeruginosa, Anabaena flos aquae, and Aphanizomenon flos aquae are among the demonstrated or suspected sources of biotoxins. In this study, a small amount of unidentified inhibitor of acetylcholine esterase was isolated from Gymnodinium breve, and also a substance highly toxic to mice was extracted from the Aphanizomenon. An additional study revealed antibiotic properties of Chondrus crispus and Euthora cristata, the red algae highly inhibitory to Chlorella. (Wilde-Wisconsin)
W71-05999

OBSERVATIONS ON FLUCTUATIONS IN THE ABUNDANCE OF PLANKTON IN RELATION TO CERTAIN HYDROLOGICAL CONDITIONS OF RIVER GANGA,
Central Inland Fisheries Research Inst., Allahabad (India).
D. V. Pahwa, and S. N. Mehrotra.
Proceedings of the National Academy of Science, India, Vol 36, Part 2, Section B, p 157-189, 1966. 11 fig, 3 tab, 36 ref.

Descriptors: *Plankton, *Fluctuation, *Hydrologic data, Distribution, Turbidity, Temperature, Hydrogen ion concentration, Dissolved oxygen, Bicarbonates, Chlorides, Nitrates, Silicates, Carbon dioxide, Carbonates, Phosphates, Seasonal, Diatoms, Rotifers, Sampling, Depth, Color, Velocity, Width, River beds, Chlorophyta, Copepods, Cyanophyta, Protozoa, Chrysophyta, Euglenophyta, Dinoflagellates, Chlorella, Scenedesmus, Euglena.
Identifiers: *Ganges River (India).

Distribution and seasonal fluctuations of plankton, relative to physicochemical factors, were studied at seven stations on the Ganges River. Temperature, turbidity, pH, dissolved oxygen, bicarbonates, chlorides, nitrates, and silicates showed similar fluctuation trends, but free carbon dioxide, carbonate and phosphate fluctuations were dissimilar. Temperature was high December-February and low May-October. Water was turbid from July-October. Dissolved oxygen values were maximum January-February and minimum July-September. Bicarbonates, chlorides and silicates were minimal during the monsoon season, maximal during the summer. Free carbon dioxide was present July-November and absent January-May; and absent during June at some stations but highest at others. Carbonates were present only during absence of carbon dioxide. Phosphates showed erratic fluctuations with maxima during monsoon. Plankton production showed bimodal cycle with one peak in June and the other sometime during December-March; July-October showed plankton minima. Peaks of zooplankton and phytoplankton mainly coincided with each other. Phytoplankton groups were more prevalent in upper river stretches. May and June mostly recorded primary peaks of the year. Diatoms and rotifers, respectively, dominated the phytoplankton and zooplankton, except at two stations where copepods exceeded rotifers. (Jones-Wisconsin)
W71-06004

PERIPHYTON ACCRUAL IN THE KASKASKIA RIVER AND ADJACENT FLOODPLAIN POOLS IN EAST-CENTRAL ILLINOIS,
Illinois Univ., Urbana. Dept. of Zoology.
Edward C. Doyle.
MS thesis, Dept of Zoology, Illinois Univ, Urbana, 1971. 119 p, 23 fig, 18 tab, 88 ref. OWRR Project B-025-ILL (1).

Descriptors: *Periphyton, *Primary productivity, *Rivers, Standing crop, Biomass, Chlorophyll, Sampling, On-site tests, Illinois.
Identifiers: *Kaskaskia River (Ill), Accrual rate, Floodplain pools.

The subject of this thesis is distribution of periphyton, a rather neglected group of primary producers. The accrual of organisms on glass slides disclosed a much larger standing crop in the Kaskaskia River than in three floodplain pools. This difference in the productivity was due to the stimulating influence of river's current and the depressing shading effect in the pools. Differences in the production of separate pools are attributed to the sporadic occurrence of Ceratophyllum. The biomass and maturity of periphyton communities are influenced by composition and depth of water, concentration of silt suspension, and the position of slides. Good agreement was observed between chlorophyll a and the periphyton biomass. The high light intensity failed to decrease the surface periphyton production. (Wilde-Wisconsin)
W71-06011

PHYSIOLOGY OF BOLL SHEDDING IN COTTON: IV. CORRELATION STUDIES ON FLOWER PRODUCTION AND BOLL SHEDDING IN RELATION TO TEMPERATURE AND RAINFALL,
Indian Agricultural Research Inst., New Delhi.
For primary bibliographic entry see Field 03F.
W71-06056

VARIATIONS IN WATER STRESS IN ONE-YEAR-OLD NEEDLES OF A PONDEROSA PINE,
New Mexico State Univ., University Park; and Arizona Univ., Tucson.
G. L. Cunningham, and H. C. Fritts.
Journal of the Arizona Academy of Science, Vol 6, No 2, p 117-120, October 1970. 1 tab, 1 fig, 9 ref. NSF Grant GB-3658.

Descriptors: *Moisture stress, *Vapor pressure, *Ponderosa pine trees, *Semiarid climates, Seasonal, Leaves, Environmental effects, Modes of action, On-site data collections, Climatic data, Metabolism, Translocation, Plant growth.
Identifiers: *Water potential.

As part of an ongoing effort to evaluate a proposed model for the influence of climate on tree-ring width, it was desirable that the influences of seasonal variation and environmental factors on leaf water status be examined. A single ponderosa pine, growing on a semiarid site at 2500 m. elevation was chosen for study because of it's 'sensitive' ring chronology, indicating that moisture frequently limits the growth of the annual ring. Needle water potentials were measured by the dye method and soil moisture conditions and atmospheric vapor pressure were measured and correlated with leaf water potential. Eight 24 hr. sampling periods were done at weekly intervals between May 1-June 27, 1965, during which time there was a general environmental drying trend. In the first half of May, soil water potential and leaf water potential were high, and the latter showed no correlation with vapor pressure deficit (VPD). In later May, soil water potential decreased and needle water potential was linearly correlated with VPD. In June, needle water potential remained high and did not vary with VPD. It is postulated that in early May, soil moisture was adequate for maintenance of leaf tissue, but in late May, soil moisture was low and needle water deficits responded to VPD. By early June, new needles had appeared and lowered osmotically active carbohydrates by rapid translocation. (Casey - Arizona)
W71-06057

RADIAL WATER AND SOLUTE FLOWS IN ROOTS OF ZEA MAYS; I. WATER FLOW,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
H. Ginsburg, and B. Z. Ginzburg.
Supported by US Department of Agriculture Grant FG-IS-181, Project No A10-SWC-31. Journal of Experimental Botany, Vol 21, No 68, p 580-592, August 1970. 4 fig, 3 tab, 25 ref.

Descriptors: *Flow, *Root systems, *Estimating equations, *Laboratory tests, *Plant tissues, Vascular tissues, Structure, Corn (Field), Mode of action, Plant physiology, Osmotic pressure, Water balance, Metabolism, Permeability, Hydraulic conductivity, Model studies, Calcium, Tritium, Inflow, Ureas, Solutes, Membranes, Membrane processes, Inhibition.
Identifiers: *Reflection coefficients, *Osmotic flow.

Differential radial movements of both water and solutes across roots are difficult to study because of structural complexity of the root system. 'Sleeve' preparations are root segments from which the central stele has been removed, leaving the epidermis, exodermis, cortex and the outer part of the broken endodermis. Although very complex, they have the advantage of being less complex than the whole root system. Sleeves were prepared, mounted in paraffin wax baths and perfused with tritiated water (HTO). When osmotic pressure differences were zero, steady state fluxes of HTO were then measured and permeability coefficients were estimated. Bathing the sleeve with DNP, a metabolic inhibitor, results in a small increase in HTO influx but in no change in efflux. Using standard flow equations, hydraulic conductivity and reflection coefficients of urea and sucrose could be calculated at known osmotic pressure differences and measured volume flow rates. The reflection coefficients were very close to 1.0. Effects of the metabolic inhibitors, DNP, CCCP and KCN, were tested on osmotic flow. At high inhibitor concentrations there was a remarkable inhibition of water flow, but almost no effect on sucrose permeability, indicating that changes in osmotic water flow could be attributed to changes in hydraulic conductivity. Several models of water flow through root tissue are discussed in light of the data. It is concluded that most of the water moving radially moves by some route additional to cell walls and is probably coupled to some chemical reactions. (Casey - Arizona)
W71-06064

EFFECTS OF IRRIGATION INTENSITY AND NITROGEN LEVEL ON THE PERFORMANCE OF EIGHT VARIETIES OF UPLAND COTTON, GOSSPYIUM HIRSUTUM L.,
Arizona Agricultural Experiment Station, Yuma.
For primary bibliographic entry see Field 03F.
W71-06068

THE ROLE OF SUCCULENT HALOPHYTES IN THE WATER BALANCE OF SALT MARSH RODENTS,
California Univ., Los Angeles. Dept of Zoology.
Harry N. Coulombe.
Oecologia, Vol 4, No 3, p 223-247, 1970. 5 fig, 3 tab, 40 ref.

Descriptors: *Salt marshes, *Rodents, *Halophytes, *Physiological ecology, *Nutrient requirements, Water balance, Animal physiology, Osmotic pressure, Chlorides, Electrolytes, Water loss, Evaporation, Saline water, Saline soils, Animal behavior, Vegetation effects, Environmental effects, California, Ecosystems, Plant physiology.
Identifiers: *Succulents, *Millet, *Torpor, *Cricetid rodents.

Soil moisture in salt marshed may be 60% greater in salt concentrations than sea water, leading to the designation of salt marshes as 'physiological deserts' Southern California salt marshes are inhabited by a number of succulent halophytes and by 3 species of cricetid rodents, Peromyscus maniculatus, Reithrodontomys megalotis (Harvest mouse) and Microtus californicus (Meadow mouse). Since fresh water is nonexistant in these areas, succulent halophytes may play a role in water balance and ecology of the rodents. Data are therefore needed on the amount of physiologically available water in the plant tissues and the osmoregulatory abilities of the animals. Hydraulic pressure sap extractions from Salicorna virginica (pickleweed) yielded average Cl ion concentrations of 955 mEq/L. and a total osmotic pressure (TOP of 1450 mOsm/L. Several other local species were analyzed and one--Suaeda fruticosa--showed increases of TOP and root depth with distance away from the lagoon's edge. Harvest mice lost an average 1.35 mg water/cc oxygen consumed through pulmocutaneous evaporation, which is among the highest water losses known for small mammals. In testing for possible water sources, different groups of harvest mice were placed on 1 of 3 regimes: (1) Pickleweed only (mean water content of 84.7% fresh weight), (2) millet only (free water content of 6% by weight and (3) Pickleweed and millet. Meadow mice were tested only on (3). The harvest mice survived only on the millet diet while meadow mice could survive on (3). Weight loss and urine analyses also led to the conclusion that succulent plants are unimportant to the normal water economy of salt marsh rodents. Possibly, harvest mice may survive short term dehydration by undergoing daily torpor. The possible roles of dew and sea water as water sources are discussed. (Casey - Arizona)
W71-06073

EFFECT OF TIME OF EXPOSURE TO SALINITY ON GROWTH, WATER STATUS AND SALT ACCUMULATION IN BEAN PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ. Jerusalem (Israel).
A. Meiri, E. Mor, and Alexandra Poljakoff-Mayber.
Supported by Israeli Ministry of Agriculture and Israeli Board. Annals of Botany, Vol 34, No 135, p 383-391, March 1970. 1 fig, 3 tab, 25 ref.

Descriptors: *Leaves, *Salinity, *Plant physiology, *Evapotranspiration, *Plant growth, Osmotic pressure, Chlorides, Potassium, Sodium, Calcium, Magnesium, Hydrogen ion concentration, Conductivity, Laboratory tests, Light, Turgidity.
Identifiers: *Water potential, *Relative water content.

Plants have shown abilities to adapt themselves to saline media, but the basic adaptive mechanisms involved are not understood. Since transpiration has been shown in some cases to facilitate absorbed ion transport in some plants, an attempt was made to investigate correlations between transpiration during salinity exposure and the growth, water status and ionic composition of the plant. Using non-saline (-0.6 bars) and saline (-2.8 bars) media, 2 series of experiments were carried out in bean plants. In one series, plants were grown continuously in either saline or non-saline media. In the second series one group was grown in saline medium during the day and non-saline at night, while conditions were reversed for the other group. The results showed that in bean plants, under conditions of relatively low evapotranspirative demand, transpiration during salinity exposure affects neither salt accumulation in the leaves nor any other effects normally associated with salinity exposure. Sap chloride levels were directly proportional to time of exposure to salinity, whether in the light or dark. K uptake also seemed proportional to time in saline media. The larger plants were exposed to saline media, the more anions were replaced by chloride. Cation levels were not significantly changed. (Casey - Arizona)
W71-06074

YIELD REDUCTION BY CONTROLLED FLOODING OF CORN,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
W71-06152

ENVIRONMENTAL EFFECTS ON WOOD PRODUCTION AND CAMBIAL ACTIVITY IN ZIZIPHUS SPINACHRISTI (L.) WILLD.,
Tel Aviv Univ. (Israel). Dept. of Botany.
Nili Liphschitz, and Y. Waisel.
Supported by a grant from the Citrus Board of Israel. Israel Journal of Botany, Vol 19, No 4, p 592-598, 1970. 4 fig, 1 tab, 10 ref.

Descriptors: *Trees, *Plant growth, *Soil-water-plant relationships, *Environmental effects, *Moisture availability, Modes of action, Seasonal, Ecology, Leaves, On-site investigations, Semiarid climates, Xylem, Phenology, Light, Laboratory tests.
Identifiers: *Israel, *Seedlings, *Cambium, *Tree rings.

Z.spina-Christi is a lowland thermophilic, shrub-like tree with a diffuse porous type xylem, native to Israel. Since it occurs in areas with differing water regimes, an attempt was made to investigate environmental control of cambial activity and annual ring features. Two groups of trees, near each other, were selected from an area about 200 m. below sea level. The first group (I) was situated on the shore of a lake where the tree roots were submerged in water. The second group (II) were scattered about the sides of an east-facing mountain side. Quantitative differences were seen between the 2 groups. With group I, cambial activity (monthly mean cell-layer production) was bimodal, with growth starting in April, peaking in May, declining to zero in June and peaking again in August. Group II showed cambial activity only in the spring. Flowering periods and leaf development were found to be associated with cambial activity, and both were strongly affected by water, indicating the water availability, in that region, is the key environmental factor which governs both the duration and rate of cambial activity. This was reinforced by increased cambial and phenological activity in a wet year. The effects of water on the radial growth seem to be indirect and mediated by the buds. Laboratory tests indicated no photoperiodic effects, either on the length of cambial activity or the type of wood product. (Casey-Arizona)
W71-06214

ESTABLISHMENT OF PERENNIAL FORAGES: I. SUBSEQUENT YIELDS; II. SUBSEQUENT ROOT DEVELOPMENT,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W71-06215

EFFECT OF IRRIGATION ON RECOVERY OF APPLIED NITROGEN BY COTTON,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Auburn Univ., Ala. Dept. of Soils.
For primary bibliographic entry see Field 03F.
W71-06216

SEED TABLETS FOR PRECISION PLANTING LETTUCE,
Arizona Agricultural Experiment Station, Mesa.
For primary bibliographic entry see Field 03F.
W71-06224

2J. Erosion and Sedimentation

HYDRODYNAMIC EFFECTS OF SEEPAGE ON BED PARTICLES,
Utah State Univ., Logan. Dept. of Civil Engineering.
Gary Z. Watters, and Manam V. P. Rao.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY3, Paper 7973, p 421-439, March 1971. 19 p, 11 fig, 11 ref. NSF Grant GK913.

Descriptors: *Seepage, *Sediment transport, *Alluvial channels, Hydrodynamics, Groundwater movement, Surface-groundwater relationships, Sediments, Sedimentation, Reynolds number, Porous media.
Identifiers: Hydrodynamic drag, Hydrodynamic lift.

The effects of effluent and influent seepage on the hydrodynamic forces acting on an idealized non-cohesive sediment particle were investigated experimentally. The hydrodynamic conditions near and within the porous medium of the channel bed were simulated through the use of shear-velocity Reynolds number and seepage Reynolds number. Drag and lift forces on a sediment particle were measured by a force dynamometer with and without the effects of effluent or influent seepage flow. The results are presented in the form of drag and lift coefficients as functions of shear-velocity Reynolds number for different effluent or influent seepage Reynolds numbers. The effects of seepage on the dynamic forces acting on a sediment particle are analyzed to explain the observed experimental results. (Knapp-USGS)
W71-05839

WATER CHEMISTRY OF TOXAPHENE - ROLE OF LAKE SEDIMENTS,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05B.
W71-05840

SEDIMENTS OF THE NORTHERN MIDDLE AMERICA TRENCH,
Woods Hole Oceanographic Institution, Mass.
David A. Ross.
Geological Society of America Bulletin, Vol 82, No 2, p 303-321, February 1971. 19 p, 12 fig, 4 tab, 24 ref. ONR Contract N00014-66-C-0241.

Descriptors: *Sedimentation, *Sediment transport, Deposition (Sediment), Geology, Stratigraphy, Sediments, Marine geology, Provenance, Sedimentary structures, Sediment distribution, Sediment yield, Sedimentation rates.
Identifiers: *Middle America Trench.

The Middle America Trench is a tectonically unstable area in which sediments have accumulated rapidly. Little sediment accumulates permanently on the continental flank seaward of this basin. Sediments from the seaward flank have more biogenous material due to a lower rate of terrigenous deposition. Heavy minerals, coarse sands in the trench, facies similarities, displaced Foraminifera, and a textural gradation along the trench axis suggest that the sediments in the trench were deposited by turbidity currents. Carbon-14 dates indicate sedimentation rates as high as 146 cm/1000 yrs in the trench bottom. Assuming constant conditions, the sediments found in the trench bottom would have taken only 4.5 million yrs to accumulate. Sediment thicknesses vary along the trench axis but are consistent with present ideas of platetectonics. Sedimentary facies of the Middle America Trench and the Gulf of California are similar due to the predominance of tectonic factors over depositional factors in these areas. (Knapp-USGS)
W71-05844

FORMATION OF LEE-SIDE LAMINAE IN AEOLIAN DUNES,
Geological Survey, Denver, Colo.; and National Park Service, Yellowstone National Park, Wyo.
Edwin D. McKee, John R. Douglass, and Suzanne Rittenhouse.
Geological Society of America Bulletin, Vol 82, No 2, p 359-378, February 1971. 20 p, 10 fig, 5 tab, 16 ref.

Descriptors: *Dunes, *Sedimentary structures, Aeolian soils, *Sands, Deposition (Sediments), Sediment transport, Moisture content, Beaches, Dry masts, Wind erosion, Winds.
Identifiers: *Sand dunes, *Eolian dunes.

Processes responsible for structures in sand dunes consist of (1) primary deposition by saltation and creep and by settling from suspension, (2) redeposition accompanying avalanching, and (3) penecontemporaneous erosion. Characteristics of dune structures were examined in the field by introducing marker beds of magnetite at times of sand deposition, thus recording original surfaces and making possible the determination of subsequent changes. Avalanching in sand is of two types: sand flow and slumping. Deformational structures characteristic of each were recorded in the field and were reproduced in the laboratory. Analysis of these structures suggests criteria for distinguishing compressional types (lower dune slope) from tensional types (upper dune slope). The analysis of deformational structures also serves to distinguish between forms developed in cohesive sand and those in non-cohesive sand. Since the degree of cohesion is largely a function of the amount of moisture in the sand the structures provide a means for recognizing original moisture content. (Knapp-USGS)
W71-05845

THE ORIGIN OF THE LABYRINTH, WRIGHT VALLEY, ANTARCTICA,
Waikato Univ., Hamilton (New Zealand). School of Science.
M. J. Selby, and A. T. Wilson.
Geological Society of America Bulletin, Vol 82, No 2, p 471-476, February 1971. 6 p, 6 fig, 10 ref.

Descriptors: *Weathering, *Geomorphology, *Antarctic, *Salts, *Joints (Geology), Erosion, Glaciers, Floods.
Identifiers: Wright Valley (Antarctica), Salt weathering.

The Labyrinth is an area of 30 sq km of steep-sided troughs, some with no outlets, cut into a sill of the Ferrar Dolerite Formation. Hypotheses for its origin include fluvial erosion by meltwater in an interglacial stage, a volcanically induced flood, jokulhlaup, glacial erosion, and sub-glacial erosion. These hypotheses are rejected as having no field evidence in their favor. It is suggested that selective salt weathering working along major joints and in areas of close-jointing is an hypothesis supported by the field evidence that it is essentially uniformitarian. (Knapp-USGS)
W71-05847

SUBAQUEOUS SLUMP STRUCTURES,
Brooklyn Coll., N.Y. Dept. of Geology.
Edward Sturm.
Geological Society of America Bulletin, Vol 82, No 2, p 481-483, February 1971. 3 p, 2 fig, 10 ref.

Descriptors: *Sedimentary structures, *Sedimentation, *Landslides, Deposition (Sediments), Bottom sediments, Marine geology.
Identifiers: *Subaqueous slump structures.

Curved, grading into planar, discordant slump scar surfaces are not uncommon in sedimentary rocks. It is suggested that the slump movement took place penecontemporaneously with the processes of sedimentation and in response to loading imbalances due to the presence of a slope. The curvature of the slump surface may be derived by resolving the vector representing the displacement, or offset, and relating its vertical component to the volume decrease associated with void ratio reduction. The particular shape of the surface is largely a function of the clay mineral content of the sediments. (Knapp-USGS)
W71-05848

SEDIMENTS OF THE MODERN NIGER DELTA: A SUMMARY AND REVIEW,
Reading Univ. (England).
J. R. L. Allen.
In: Deltaic Sedimentation, Modern and Ancient, Morgan, James P. and Shaver, Robert H., editors, The Society of Economic Paleontologists and Mineralogists Special Publication No 15, 138-151, November 1970. 14 p, 6 fig, 22 ref.

Descriptors: *Deltas, *Sedimentation, *Sedimentary structures, Deposition (Sediments), Sediment transport, Waves (Water), Bed load, Suspended load, Sedimentology, Stratigraphy, Coastal plains, Flood plains, Swamps, Beaches.
Identifiers: *Niger Delta (Africa).

The modern Niger delta exemplifies a type of delta in which sand as well as mud is supplied to a receiving water body of high energy. The depositional environments, and corresponding sedimentary facies, are distributed concentrically within the deltaic region. The deltaic plain is divisible into the floodplain (upper and lower), tidal swamp, and beach-barrier environments. The depositional environments present in the submerged part of the delta are: river-mouth bars, delta-front platform, prodelta slope, and open shelf. There are also in the submerged part of the delta large areas where littoral and subtidal sands due to the Flandrian transgression are still exposed at the surface of sedimentation. The deltaic deposits decrease horizontally in grain size from the floodplain to the open shelf but vertically increase in coarseness from the silty clays of the open shelf to the predominantly fine- to medium-grained sands of the floodplain. (Knapp-USGS)
W71-05856

DEPOSITIONAL SEQUENCES AND SAND DISTRIBUTION IN THE POSTGLACIAL RHONE DELTA COMPLEX,
Shell Development Co., Ventura, Calif.
Eppo Oomkens.
In: Deltaic Sedimentation, Modern and Ancient, Morgan, James P. and Shaver, Robert H., editors, The Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 198-212, November 1970. 15 p, 10 fig, 1 tab, 17 ref.

Descriptors: *Deltas, *Sedimentation, *Texas, *Gulf of Mexico, *Sedimentary structures, Deposition (Sediments), Sediment transport, Bed load, Suspended load, Sedimentology, Stratigraphy, Coastal Plains.
Identifiers: *Rhone Delta (France).

An analysis of the lithological relationships in the postglacial Rhone delta complex of France shows that the deltaic sediments can be grouped in one of the following depositional sequences: (a) transgressive sequences, (b) regressive sequences, and (c) channel-fill sequences. Transgressive sequences are due to a process whereby the rate of subsidence exceeds that of sedimentary buildup. This process leads to deposition of a sediment body in which coastal plain deposits are overlain by coarse-grained coastal barrier deposits that are in turn overlain by marine deposits. Regressive sequences are due to a process whereby sediment-laden river water enters a basin that is filled with water of higher density (for example, sea or lagoon). This process produces a sediment body that contains fine-grained sediment at its base and dominantly coarse-grained sediment at its top. Channel-fill sequences are due to a process whereby a decrease in current velocity occurs in a channel. This process produces a sediment body that contains coarse-grained sediment at its base and dominantly fine-grained sediment at its top. (Knapp-USGS)
W71-05857

SEDIMENTATION IN A MALAYSIAN HIGH TIDE TROPICAL DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
James M. Coleman, Sherwood M. Gagliano, and William G. Smith.
In: Deltaic Sedimentation, Modern and Ancient, Morgan, James P. and Shaver, Robert H., editors, The Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 185-197, November 1970. 13 p, 17 fig, 5 ref. ONR Contract Nonr 1575 (03), Task Order NR 388 002.

Descriptors: *Deltas, *Sedimentation, *Texas, *Gulf of Mexico, *Sedimentary structures, *Tropical regions, Deposition (Sediments), Sediment

transport, Bed load, Suspended load, Sedimentology, Stratigraphy, Coastal Plains, Wet climates, Monsoons.
Identifiers: *Klang-Langat Delta (Malaysia).

The compound delta of the Klang and Langat Rivers on the Malay Peninsula illustrates the processes, morphology and sedimentary framework associated with a number of small high tidal deltas found in tropical southeast Asia. Both the delta and its catchment basin are located in the wet tropics and have mean annual rainfall ranging from 80 to 110 inches. Wave-energy levels along the delta coast are low to moderate. However, the range of mean spring tides is 14 feet; therefore, tidal processes dominate sediment dispersal patterns and control delta form. Characteristics of the delta include parallel ridge-and-trough bottom topography on the sea floor in the delta vicinity, large areas of low tide flats, complex networks of streams that serve the dual function of tidal streams and river distributaries, extensive mangrove swamps, and large fresh-water peat swamps. Associated with these features and environments are distinctive sedimentary facies. (Knapp-USGS)
W71-05858

HYDROGRAPHY, SEDIMENT DISPERSAL, AND RECENT HISTORICAL DEVELOPMENT OF THE PO RIVER DELTA, ITALY,
South Carolina Univ., Columbia.
Bruce W. Nelson.
In: Deltaic Sedimentation, Modern and Ancient, Morgan, James, P. and Shaver, Robert H., editors, The Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 152-184, November 1970. 33 p, 27 fig, 3 tab, 37 ref. Grant GP-525 NSF1.

Descriptors: *Deltas, *Sedimentation, *Sedimentary structures, Deposition (Sediment), Sediment transport, Waves (Water), Bed load, Suspended load, Sedimentology, Stratigraphy, Coastal plains, Flood plains, Swamps, Beaches.
Identifiers: *Po River Delta (Italy).

Significant parameters of the Po Delta, Italy, include a mountainous source area near the site of deltaic deposition, a freshwater discharge of nearly 1,500 cubic meters/ second, a sediment load that consists predominantly of sand and silt, a tidal range of 60 centimeters, a quiet sea of high salinity, and a locus of deposition on a shallow shelf that subsides slowly in the vicinity of the delta. The artificial form of the modern delta is caused by manmade works constructed in historical times to control the distributaries. Today 60 percent of the river flow and 75 percent of the sediment load discharge through a single distributary. The delta advances in front of the controlled distributaries at rates that are very much higher than those that characterized the prehistoric delta. Profiles of salinity, temperature, and suspended sediment concentration obtained within the distributaries, in front of the delta, and in the Adriatic Sea illustrate the kinds of interactions between fresh and salt water that lead to sediment dispersal and deposition. (Knapp-USGS)
W71-05859

FACIES AND DEVELOPMENT OF THE COLORADO RIVER DELTA IN TEXAS,
Esso Production Research Co., Houston, Tex.
William H. Kanes.
In: Deltaic Sedimentation, Modern and Ancient, Morgan, James P. and Shaver, Robert H., EDITORS, The Society of Economic Paleontologists and Mineralogists Special Publication No 15, p 78-106, November 1970. 29 p, 25 fig, 5 tab, 65 ref.

Descriptors: *Deltas, *Sedimentation, *Texas, *Gulf of Mexico, *Sedimentary structures, Deposition (Sediments), Sediment transport, Bed load, Suspended load, Sedimentology, Stratigraphy, Coastal Plains.
Identifiers: *Colorado River Delta (Tex)

The recent delta of the Colorado River of Texas is an exceptional model for analyzing sediment and faunal facies relationships in environments associated with deltas. Because of the delta's small size it is feasible to obtain closely spaced cores to provide the information essential for making a detailed facies study. Moreover, air photographs document (1) growth from a linear shoreline to the lobe-shaped deposit formed prior to artificial channeling of the river through a barrier island and (2) development of an 8- to 10- foot-thick platform of deltaic sediments, which divides Matagorda Bay, during the 6-year period following removal of an upstream log jam. This study of delta progradation was concentrated in the northeastern part of the Colorado delta, an area unaffected by manmade modifications. Continuous cores and borings define the deltaic facies complex and the underlaying bay facies. The sequence of facies and environments from the surface downward is (1) delta-plain root-mottled clay and silt (1 to 5 feet thick) with 'algal crusts' giving way locally to massive and burrowed clays of the channel-fill environment; (2) delta-front sand (2 to 8 feet thick), characterized by small-scale crossbedding, which grades laterally into finer grained sediment; (3) prodelta reddish-brown laminated silty clays (1 to 5 feet thick); and (4) bay laminated and burrow-mottled silty clays and clayey silts (10 to 14 feet thick), which lie unconformably on the Pleistocene. (Knapp-USGS).
W71-05860

BOTTOM SEDIMENT SAMPLING,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 07B.
W71-05886

A STUDY OF FRESHWATER SAND GRAIN SURFACES BY SCANNING ELECT RON MICROSCOPY,
Illinois Univ., Urbana. Dept. of Geology.
For primary bibliographic entry see Field 07B.
W71-05887

THE QUALITATIVE DISTRIBUTION OF FELDSPARS IN SURFICIAL BOTTOM SEDIMENTS FROM LAKE ONTARIO,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
Richard L. Thomas.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 364-379, 1969. 16 p, 8 fig, 3 tab, 8 ref.

Descriptors: *Bottom sediments, *Lake Ontario, *Mineralogy, Great Lakes, Sedimentation, Sediment transport, Bed load, Suspended load, Provenance, Deposition (Sediments), Sampling, Data collections, Weathering, Water chemistry, Paleoclimatology.
Identifiers: *Feldspars.

A qualitative assessment of the feldspar distribution in Lake Ontario sediments was made by the determination of the feldspar end members, K, Na and Ca, on sediment residues after fusion with potassium pyrosulphate. Both K adsorption and cation exchange of Na and Ca for K in standard feldspars was observed. Cation exchange is minimal in samples and in standards with a full particle size range. K adsorption is high yet appears to be constant and not directly related to grain size. In the inshore zones a poor positive correlation of feldspar to quartz is believed to be the result of poor mixing in a traction load sediment. In the basin zones the relationship is of a higher order and reflects natural sorting by sedimentation from a suspended load. The regional distribution of the feldspars shows an inshore to offshore decrease, initially, of calcic feldspar, then of sodic feldspar leading to a basin enrichment of the potash feldspars, microcline and orthoclase. The feldspars a probably derived predominantly by coast line er sion of glacial deposits surrounding Lake Ontari (See also W71-05561) (Knapp-USGS)
W71-05889

GEOLOGICAL, CHEMICAL, AND PHYSICA ATTRIBUTES OF SEDIMENTS IN SENEC LAKE, NEW YORK,
Hobart Coll., Geneva, N.Y.; and Michigan Uni Ann Arbor. Dept. of Meteorology and Oceano raphy.
Donald L. Woodrow, Thomas R. Blackburn, and Edward C. Monahan.
In: Proceedings Twelfth Conference on Gre Lakes Research, May 5-7, 1969, University Michigan, Ann Arbor: International Associatio for Great Lakes Research, p 380-396, 1969. 17 p, fig, 7 tab, 11 ref, append. US Navy Contra N70024-68-C-0190, Underwater Sound Lab.

Descriptors: *Bottom sediments, *Sedimentatio *Sediment transport, *Lakes, Suspended load, Be load, Mineralogy, Particle size, Profiles, Glaci drift, Seismic studies, Sounding, Stratificatio Stratigraphy, Bathymetry, Water chemistry.
Identifiers: *Seneca Lake (NY).

In Seneca Lake, New York, coarse-grained heterogeneous sediments cover the bottom nea the shoreline; fine-grained, cohesive clays occur o the lake slope; and very fine-grained, non-cohesiv muds are found on the floor of the deep lake. Clay comparable to those exposed on the lake slope ar overlain at the top of the slope by near-shore sedi ments and at the base of the slope by deep lak sediments, suggesting that the lake slope sediment are the oldest ones sampled. Values of chemica and physical parameters are plotted and contoure on maps of the Lake. The contours are generall parallel to bathymetric contours. Oxygen value are highest in near-shore sediments, sulfide an chloride values are highest in the deep lake sedi ments, and pH is near neutrality in all sediments Densities of the sediments range from 1.85 near th shoreline to 1.05 in the deep lake. The shea strength of near-shore sediments is approximately three times that of deep lake sediments. Seismi data indicate that the bedrock profile is a broad 'V and the total thickness of the lake sediments varies from about 600 ft in the axial part of the Lake t zero at, or near, the shoreline. A complex series o lake-filling events is indicated but the presently operative processes of clastic transport appear t account for much of the younger material making up the fill. (See also W71-05561) (Knapp-USGS)
W71-05890

CHEMICAL CHARACTERIZATION OF BOT-TOM SEDIMENTS,
Environmental Protection Agency, Cincinnati, Ohio. Water Quality Office.
For primary bibliographic entry see Field 05A.
W71-05981

THE UPLAND FOREST VEGETATION OF THE BOIS BRULE RIVER BASIN, TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Dept of Biology.
Donald W. Davidson.
Wisconsin State University, Superior, Center for Lake Superior Environmental Studies, Contribution No 17, 1970. 13 p, 21 ref. OWRR Project A-023-Wis (5).

Descriptors: *Forest soils, *Forests, *Sediment control, Erosion control, Forest management, Water conservation, Soil erosion, Surface runoff, Drainage effects, Lake Superior, Watersheds (Basins), Wisconsin, Sediment load, Sampling, Soil stabilization, Vegetation.
Identifiers: *Brule Basin (Wis), Red clay soils.

The Brule River Basin (Wisconsin) was the study site on upland forest vegetation in conjunction with studies of sediments and water chemistry of the

Brule River. Dominant tree species were sampled in 51 stands, representative of various stages of xeric northern forests. Most of the Brule Basin is presently forested, serving as an important water control agent; uncut forested land decreases the sediment load transported to Lake Superior. Clear-cutting clearing on red clay will result in a raised water table and may prove disastrous. Some erosion problems arose from farming practices, road construction, and right-of-way operations through the red clay zone. Observations indicate that the south shore of Lake Superior is partially caving in due to unknown causes. A red clay soil area of 380,000 acres is severely eroded and produces high sediment loads to Lake Superior; stabilization vegetation of exposed red clay surfaces is emphasized. Land use and proper land management are critical considerations to the ecology of the Great Lakes. (Auen-Wisconsin)
W71-05987

THE NET EXCHANGES OF PHOSPHORUS BY ESTUARINE SEDIMENTS IN FLOWING WATERS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Herbert L. Davis, III.
MS thesis, Dep of Zoology, North Carolina State Univ, Raleigh, 1968. 41 p, 3 tab, 23 ref, 3 append. OWRR Project B-004-NC (7).

Descriptors: *Phosphorus, *Sediments, Sands, Mud, Transport depletion, Water pollution sources, Water pollution effects, Model studies, Estuaries, Analysis.
Identifiers: *Net mass transport, Phosphorus exchange, Formaldehyde.

Sand and mud from the Pamlico Estuary (NC) were placed into two sets of troughs while a third set of troughs was left without sediment. Estuarine water was gravity fed through the troughs either untreated or enriched in potassium phosphate with or without formaldehyde. The net mass transports of reactive and unreactive phosphorus were recorded by analyses. As indicated by student's t test, significant mass transports were obtained for mud sediment which retained dissolved reactive phosphorus. No significant mass transport was obtained for sand due to its low retention capacity. A suggestion is made that the variability of the results could be decreased by the use of chemostat water pumps, phosphorus-32, and larger samples. (Wilde-Wisconsin)
W71-06010

THE MATTHES ROLLING DIAMETER AS AN INDICATOR OF CHANNEL STABILITY,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
H. F. Nevins.
Journal of Hydrology (New Zealand), Vol 7, No 1, p 47-50, 1968. 4 p, 1 fig, 1 ref.

Descriptors: *Sediment transport, *Bed load, Gravels, Channel morphology, Discharge (Water), Sedimentation, Sediment load, Tractive forces.
Identifiers: *New Zealand.

In mature rivers, the rolling diameter of the largest stone on the deepest part of the bed, together with the bank-full depth, will give an indication of the river slope. 'Rolling diameter' is defined as that diameter on which a stone rolls as if it were a barrel. These observations are easily made, and a high degree of accuracy is not necessary. The method was applied to a number of New Zealand rivers. Most of the first observations made showed reasonable agreement with the Matthes diagram. Observations made on stable reaches, particularly after a flood, gave a good fit, almost invariably in the torrent part of the diagram. When the reach was unstable, or the bed was masked by smaller swelling shingle, there was no fit. The method therefore provides a useful guide to the state of equilibrium of the reach. If there is no fit, then the bed is masked by sediments usually smaller than those required or the formation of a stable bed. (Knapp-USGS)
W71-06169

THE SAN SIMON WATERSHED: REVEGETATION,
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 04D.
W71-06223

PINYON-JUNIPER CONTROL: WHERE. WHY,
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Univ., Tucson. Dept. of Range Management.
For primary bibliographic entry see Field 04D.
W71-06225

FLOOD PLAIN INFORMATION, ONTONAGON RIVER, ONTONAGON, MICHIGAN, AND LAKE SUPERIOR SHORELINE, ONTONAGON COUNTY, MICHIGAN.
Stanley Consultants, Inc., Muscatine, Iowa.
For primary bibliographic entry see Field 04A.
W71-06232

2K. Chemical Processes

GEOCHEMICAL SURVEY OF MISSOURI, PLANS AND PROGRESS FOR SECOND SIX-MONTH PERIOD (JANUARY-JUNE, 1970).
Geological Survey, Denver, Colo. Regional Geochemistry Branch.

Geological Survey Environmental Geochemistry Report, June 1970. 60 p, 7 fig, 10 tab, 24 ref.

Descriptors: *Geologic investigations, *Chemical analysis, *Soil-water-plant relationship, Water analysis, *Missouri, Analytical techniques, Methodology, Laboratory tests, Spectrophotometry, X-ray fluorescence, Colorimetry, Gravimetric analysis, Test procedures, Geology, Soil tests, Vegetation, Aquifers, Groundwater, Aquifer characteristics.
Identifiers: *Environmental Health Center (U of Mo), Atomic absorption.

This is the second-six-month progress report on studies in environmental geochemistry in the State of Missouri initiated on behalf of the Environmental Health Surveillance Project in July, 1969. The studies provide general information pertaining to the occurrence and distribution of chemical elements in rocks, soils, plants, and water throughout the State. Because the environmental geochemistry studies in Missouri may extend over a considerable period of time, perhaps 5 years, it is important to maintain consistency in laboratory methods from the beginning of the project to the end. This will insure that observed geochemical variation reflects actual variation in the materials sampled rather than changes in laboratory methodology. The analytical methods for rocks, soils, plants, and water are presented. The phase of the project directed at the water of the State so far has been concerned with the problems of sampling underground waters, as these are expected to best represent the geochemical environment. (Woodard-USGS)
W71-05854

UREA CONVERSION TO AMMONIA IN WATERLOGGED SOILS,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
R. D. Delaune, and Wm. H. Patrick, Jr.
Soil Science Society of America Proceedings, Vol 34, No 4, p 603-607, July-August 1970. 5 p, 7 fig, 3 tab, 12 ref.

Descriptors: *Ureas, *Hydrolysis, *Ammonia, *Soil water, *Saturated soils, Chemical reactions, Ionization, Chemical properties, Rates, Timing, Volatility, Methodology, Test procedures, Agriculture, Rice, Chemical analysis.
Identifiers: *Urea hydrolysis, *Ammonia volatilization.

There was little or no difference in the rate or extent of urea hydrolysis in waterlogged soils and in soils kept at one-third bar moisture. Under both moisture conditions, urea hydrolysis proceeded at an initial rate of about 8 to 12 ppm per hour and began to level off after about 24 hours in most of the soils studied. About one-half to three-fourths of the urea was converted to ammonia after 3 to 4 days of incubation. The soil pH at which maximum conversion of urea occurred was about pH 8 for both moisture conditions. Ammonia loss from surface applied urea was slightly greater under one-third bar moisture conditions than under waterlogged conditions, although in neither case was the loss large at moderate rates of urea application. Ammonia loss was very low from surface-applied ammonium sulfate. In flooded soils the conversion of surface applied urea to ammonia took place in the soil and not in the flood water. (Woodard-USGS)
W71-05866

EH AS AN OPERATIONAL PARAMETER IN ESTUARINE STUDIES,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 02L.
W71-05873

GEOCHEMICAL SURVEY OF MISSOURI, PLANS AND PROGRESS FOR FIRST SIX-MONTH PERIOD (JULY-DECEMBER, 1969).
Geological Survey, Denver, Colo. Regional Geochemistry Branch.

Geological Survey Environmental Geochemistry Report, December 1969. 49 p, 8 fig, 15 ref.

Descriptors: *Geologic investigation, *Soil-water-plant relationships, *Geology, *Geochemistry, *Missouri, Soil chemistry, Chemical properties, Soil analysis, Geological surveys, On-site investigations, Vegetation, Rock properties, Grasses, Trees, Chemical analysis.
Identifiers: *Environmental Health Center (Univ of Mo).

This survey is being made on behalf of the Environmental Health Center of the University of Missouri, and is intended to estimate the abundance and distribution of elements in rocks, soils, vegetation, and water throughout the State. The principal effort during the first 6 months (July to December, 1969) of the project has been in gaining a familiarity with the rocks, soils, and vegetation of the State. Some preliminary sampling programs designed to estimate the chemical variability in soils and selected vegetation were executed and examinations were made of contamination in rocks, soils, and vegetation along highways. The observations are based principally on the results of about 500 preliminary analyses. The very large amounts of lead and zinc present in the roadside trees, contrasted with the small amounts in trees away from the road, strongly suggest that the high values resulted from road contamination. The upper limit of analysis for lead was 5,000 ppm. (Woodard-USGS)
W71-05874

THE USE OF CONCENTRATIONS OF ELECTROLYTES AND NATURALLY FLUORESCENT MATERIALS TO STUDY WATER MASS MOVEMENTS IN A FRESHWATER 'ESTUARY',
Michigan Technological Univ., Houghton. Dept. of Bio Sciences.
For primary bibliographic entry see Field 02L.
W71-05877

SOME VARIATION IN THE QUALITY OF WATER FROM THE SOURCE AND MOUTH OF THE NIAGARA RIVER,
State Univ. of New York, Buffalo. Dept. of Biology.
For primary bibliographic entry see Field 05A.
W71-05881

DISSOLVED MINERAL QUALITY OF GREAT LAKES WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-05883

GEOCHEMICAL SYSTEMS IN ONONDAGA LAKE (CENTRAL NEW YORK STATE) COMPARED WITH THE GREAT LAKES,
Slippery Rock State College, Pa. Dept. of Geology.
For primary bibliographic entry see Field 02H.
W71-05888

ON THE OCCURRENCE OF TRANS-3-HEXADECANOIC ACID IN CHLORELLA CELLS, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.
G. L. Klyachko-Gurvich, V. E. Semenenko, and A. G. Vereshchagin.
English summary. Biokhimiya, Vol 35, No 4, p 808-814, 1970. 1 fig, 4 tab, 26 ref.

Descriptors: *Cytological studies, *Organic acids, *Lipids, *Chlorella, Biochemistry, Metabolism, Analytical techniques, Light, Nitrogen.
Identifiers: *T3H, *Trans-3-hexadecanoic acid, Linolenate, Palmitate, Chloroplasts.

The partition and gas-liquid chromatography revealed that the X-acid of lipids in Chlorella cells is the trans-3-hexadecanoic acid (T3H), which comprises up to 3.5% of the total content of fatty acids. In nitrogen-starved cells, the T3H constitutes 2.0 to 4.9% of the tri-gliceroids. With an increase in light intensity T3H concentration increases from 1.7 to 4.8%. A positive correlation was established, at different light intensities, between the T3H content and the concentration of linolenate and palmitate. Consideration is given to the possibility of a participation of the T3H and linolenates in the biosynthesis of chloroplast lipids. (Wilde-Wisconsin)
W71-05989

CONDITIONS AFFECTING THE REDUCTION OF IRON AND MANGANESE BY BACTERIA IN THE ORE-BEARING LAKES OF THE KARELIAN ISTHMUS,
Akademiya Nauk SSSR, Leningrad. Institut Tsitologii.
E. P. Troshanov.
Microbiology, Vol 38, No 4, p 634-643, 1969. 1 fig, 5 tab, 8 ref.

Descriptors: *Iron, *Bacteria, *Manganese, *Demineralization, Lakes, Oxides, Aerobic bacteria, Carbohydrates, Nitrogen compounds, Bottom sediments, Oxygen, Enzymes, Hydrogen ion concentration, Oxidation-reduction potential, Ions, Organic acids, Soil bacteria, Water purification, Adsorption.
Identifiers: *Karelian Isthmus (SSR), Ferric hydroxide.

Wide distribution and variety of bacteria which reduce iron and manganese oxides in bottom deposits of Karelian Isthmus lakes have been studied, together with the effect of anaerobic conditions, sources of ferric oxide, carbohydrates, and nitrogen-containing compounds influencing ability of bacteria isolated from bottom deposits to reduce iron and manganese. Iron reduction increases in the majority of strains under conditions of oxygen deficiency, and decreases only in the case of aerophilic strains, manganese reduction is affected by anerobic conditions to a lesser degree. Freshly precipitated ferric hydroxide is reduced more intensively by weak and vigorous strains than is iron ore. Oxidized nitrogen (potassium nitrate) inhibits iron reduction by all strains, especially by those of low activity, without affecting manganese reduction. Effect of carbohydrates on the capacity of bacteria for iron reduction varies, depending on a combination with a nitrogen-containing component and on the strain species. Bacterial cultures reduce iron by an enzymatic process; reduction of manganese oxides partially proceeds by oxidation-reduction reactions with reducing substances. Unlike iron, small amounts of manganese ions are found in sterile substrates with reducing sugars or with some organic acids. (Jones-Wisconsin)
W71-05993

GRAPHIC DISSOLVED OXYGEN COMPUTATION,
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 01A.
W71-06121

WATER QUALITY OF THE DELAWARE RIVER ESTUARY, JULY THROUGH DECEMBER 1967,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05A.
W71-06156

METHODS FOR CHEMICAL ANALYSIS OF FRESH WATERS.
Hydrobiologisch Institutt, Nieuwersluis, (Netherlands); and Westfield Coll., London (England).

International Biological Programme Handbook No 8 (Second Printing), 1970: Blackwell Scientific Publications, Oxford and Edinburgh. 166 p, 29 fig, 15 tab, 157 ref.

Descriptors: *Water analysis, *Methodology, *Chemical analysis, *Water chemistry, *Conferences, Laboratory tests, On-site tests, Water properties, Inorganic compounds, Organic compounds, Colorimetry, Chromatography, Fluoremetry, Electrophoresis, Flame photometry, Spectrophotometry.

This manual is based on discussions during the IBP (International Biological Program) Technical Meeting Chemical Environment in the Aquatic Habitat, held in Amsterdam and Nieuwersluis, October 10-16, 1966. Methods of analysis for groups of compounds were considered by working groups, and the edited reports of the chairmen of these groups form the basis of the manual. This manual of chemical methods is meant as a guide for research workers interested in those biological processes in fresh water, that lead, with interconversion of energy, to the production of organic material. The chemical environment is important for many of these processes and the methods may help to describe it. Many of the methods are intended for application only to filtered water. Some may also be used for particulate matters as well. As a rule, only those methods are included which have been tested in use, either by participants of the technical meeting or in limnological laboratories known to them. The working conditions in limnological research vary from field work to laboratory work in advanced institutions. Keeping this in mind this manual is conceived on three levels of refinement of methods with differences in the necessary experience, exactitude and complexity of equipment or apparatus involved. Most determinations are therefore described-if possible-at three different levels, although the different levels are often variations on one theme. (Woodard-USGS)
W71-06159

SODIUM, MAGNESIUM, AND CALCIUM SULFATE ION-PAIRS IN SEAWATER AT 25C,
Oregon State Univ., Corvallis. Dept. of Oceanography
Dana R. Kester, and Ricardo M. Pytkowicz.
Limnology and Oceanography, Vol 14, No 5, p 686-692, September 1969. 7 p, 5 tab, 28 ref.

Descriptors: *Water chemistry, *Sulfates, *Sea water, Calcium sulfate, Sodium sulfate, Magnesium, Ions, Chemical reactions, Equilibrium.
Identifiers: Ion-pairs (Sea water).

The stoichiometric association constant of CaSO4 ion-pairs was found to be 10.8 plus or minus 0.7 at 25C at an effective ionic strength of 0.67 and at 1 atm pressure. The percentages of free and ion-paired species in seawater were calculated from the experimentally determined association constants of NaSO4, MgSO4, and CaSO4 ion-pairs. The results were used to calculate the effective ionic strength of seawater and to account for the difference in activity coefficients in seawater and in single-salt solutions. (Knapp-USGS)
W71-06166

EFFECT OF TEMPERATURE ON THE pH OF SEAWATER,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
Joris M. Gieskes.
Limnology and Oceanography, Vol 14, No 5, p 679-685, September 1969. 7 p, 5 tab, 18 ref.

Descriptors: *Hydrogen ion concentration, *Water temperature, *Sea water, Carbonates, Carbon dioxide, Equilibrium, Measurement, Water chemistry, On-site tests, Laboratory tests.
Identifiers: *Water temperature-pH relations.

The temperature coefficient of the pH of seawater, calculated from existing data on the carbonate system in seawater, was confirmed experimentally as ..0.0114 pH units per degree Celsius at 1 atm pressure. Direct pH measurements on seawater are accurate only to about 0.02 pH units hence computations of components of the carbonate system are uncertain by 1% in bicarbonate and 5% in carbonate. These uncertainties can be halved if pH values are derived from precise determination of other components of the carbonate system, such as alkalinity and total CO2. (Knapp-USGS)
W71-06167

WELL RECORDS, DEPTH-TO-WATER MEASUREMENTS, CHEMICAL ANALYSES OF GROUND WATER, DRILLERS LOGS, AND ELECTRIC-LOG INFORMATION IN HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS,
Geological Survey, Little Rock, Ark.
For primary bibliographic entry see Field 04B.
W71-06229

2L. Estuaries

SEDIMENTS OF THE NORTHERN MIDDLE AMERICA TRENCH,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02J.
W71-05844

DEFORMATION OF LEE-SIDE LAMINAE IN EOLIAN DUNES,
Geological Survey, Denver, Colo.; and National Park Service, Yellowstone National Park, Wyo.
For primary bibliographic entry see Field 02J.
W71-05845

FACIES AND DEVELOPMENT OF THE COLORADO RIVER DELTA IN TEXAS,
Esso Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 02J.
W71-05860

EH AS AN OPERATIONAL PARAMETER IN ESTUARINE STUDIES,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
M. Whitfield.
Limnology and Oceanography, Vol 14, No 4, p 547-558, July 1969. 12 p, 10 fig, 30 ref.

Descriptors: *Oxidation - reduction potential, *Hydrogen ion concentration, *Sea water, *Estuaries, Instrumentation, Water analysis, Water chemistry, Chemical potential, Chemical reactions, Water quality, Aqueous solutions.
Identifiers: Estuarine water.

Quantitative interpretation of Eh measurements in natural aqueous systems is difficult because of problems associated with the technique of measurement, the performance of the inert metal electrode, and the thermodynamic behavior of the environment. However, the parameter is useful as a semiquantitative indicator of the degree of stagnation of a particular environment. A compound probe is described that reduces the technical problems and enables pH, Eh, and pS (-2) measurements to be made simultaneously on a single sample. With this probe, Eh can be used as an operational parameter to map the distribution of estuarine sediments. (Knapp-USGS)
W71-05873

HE USE OF CONCENTRATIONS OF ELECROLYTES AND NATURALLY FLUORESCENT IATERIALS TO STUDY WATER MASS MOVEIENTS IN A FRESHWATER 'ESTUARY',
lichigan Technological Univ., Houghton. Dept. of io Sciences.
ames D. Spain, David B. Drown, and James M. anko.
: Proceedings Twelfth Conference on Great akes Research, May 5-7, 1969, University of ichigan, Ann Arbor: International Association r Great Lakes Research, p 723-733, 1969. 11 p, 8 , 15 ref.

escriptors: *Electrolytes, *Fluorescence, *Water emistry, *Estuaries, *Lake Superior, Mixing, ermal stratification, Water circulation, Currents Vater), Chlorides, Winds, Stratified flow, Water mperature, Turnovers, Tracers, Tracking chniques, Great Lakes.
entifiers: *Keweenaw Waterway (Mich).

he Keweenaw Waterway of the Upper Peninsula Michigan is a drowned pre-glacial river valley in nich the Sturgeon River and several smaller reams meet with the waters of Lake Superior in a anner which is physically similar to that which ocrs in an estuary. Chloride ion concentration, mperature and natural fluorescence have been idied at various depths and various stations in the aterway over the past 22-month period. Waters ntaining as high as 150 ppm chloride move into e Portage Lake from Torch Lake during the riod of winter stagnation forming three distinct ers according to water source. After spring overn there is a uniform concentration of about 30 m chloride. Wind-driven currents of Lake Surior water enter the Waterway during the mmer as a dense cold wedge on the bottom. By e end of fall overturn, the chloride concentration s been reduced to about 6 ppm by flushing acn. The relative contribution of water from the ee major sources is estimated by solution of uations involving chloride concentration and ural fluorescence. (See also W71-05561) (Kpp-USGS)
71-05877

STUDY OF RELATIONSHIPS BETWEEN OOPLANKTON ABUNDANCE AND LECTED ENVIRONMENTAL VARIABLES IN E PAMLICO RIVER ESTUARY OF EASTN NORTH CAROLINA,
rth Carolina State Univ., Raleigh. Dept of ology.
r primary bibliographic entry see Field 02I.

W71-05985

EUTROPHICATION STUDIES OF A SHALLOW INLET ON VANCOUVER ISLAND,
Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station.
Michael Waldichuck.
Journal Water Pollution Control Federation, Vol 41, No 5, Part 1, p 745-764, 1969. 15 fig, 2 tab, 14 ref.

Descriptors: *Estuaries, *Flushing, *Eutrophication, Water pollution effects, Water pollution control, Tides, Effluents, Sampling, Salinity, Temperature, Nutrients, Canals, Dredging, Water pollution sources.
Identifiers: *Vancouver Islands (Canada), *George Narrows (Canada), *Portage Inlet (Canada), Seasonal variations.

While nutrient input into Portage Inlet (British Columbia) is not large, volume of the system is small and flushing mechanism so poor that nutrients tend to concentrate. Phosphates and nitrates are absorbed by plankton and deposited. Provincial Government plans for a canal from Thetis Cove to Portage Inlet with locks for flushing the system rapidly appears a solution. Ecology will be modified and summer temperature in Portage Inlet will be reduced, making it less suitable for bathing--a small price for cleaner water to be regularly replaced by tidal action and for navigation improvement. Dredging might restore the inlet system removing much of the nutrients fixed in the sediments and rooted vegetation, but can be only a palliative if nutrients sources from the drainage system are not eliminated. Effect on ecology is unknown. It is conceivable that removal of rooted aquatics would lead to greater availability of nutrients to plankton resulting in undesirable concentrations of 'red tide' type organisms. (Jones-Wisconsin).
W71-05988

STUDIES OF MARINE ESTUARINE ECOSYSTEMS DEVELOPING WITH TREATED SEWAGE WASTES,
North Carolina Univ., Chapel Hill; and North Carolina Univ., Morehead City. Inst. of Marine Sciences.
H. T. Odum, and A. F. Chestnut.
National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report for 1969-70, May 15, 1970. 364 p, 167 fig, 80 tab, 81 ref, append. NSF Grant No GH-18.

Descriptors: *Estuaries, *Water pollution effects, *Biological communities, *Interfaces, *Foods, Ecosystems, Waste water (Pollution), Sewage, Salinity, Bacteria, Photosynthesis, Algae, Animals, Aquiculture, Artificial use, Model studies, North Carolina.
Identifiers: *Morehead City (NC), *Calico Creek (NC), Treated sewage, Energy circuit.

The test grounds of this study include a small estuary, Calico Creek (North Carolina), and three ponds which accept estuary water enriched in sewage after secondary treatment. Three control ponds receive tap water and estuarine water. The report provides in a graphic form salinity regime, photosynthetic productivity and respiration, concentration of phosphorus and nitrogen, and population dynamics of bacteria, algae, and animals. A possibility is advanced of attaining an interface system between municipal wastes and normal estuaries that would provide a medium for aquiculture and waste purification. (See also W71-06013 thru W71-06023) (Wilde-Wisconsin)
W71-06012

FUNGAL SURVEY IN WASTE PONDS AND CREEK,
North Carolina Univ., Chapel Hill. Dept. of Botany.
B. Rao, and W. Koch.

Studies of marine estuarine ecosystems developing with treated sewage wastes. National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 287-310, May 15, 1970. 4 fig, 10 tab, 9 ref.

Descriptors: *Fungi, *Estuaries, Salinity, Water pollution effects, Biodegradation, Decomposing organic matter.
Identifiers: *Morehead City (NC), *Calico Creek (NC), Treated sewage, Phycomycetes, Ascomycetes, Deuteromycetes, Fungi imperfecti.

The study during June and July (1969) revealed the presence in the control and sewage-enriched waters 8 phycomycetes, 6 ascomycetes, and 7 fungi imperfecti species. Phycomycetes were largely confined to water and sediments, whereas other species, to plant material. Investigation revealed a pronounced effect of salinity on the growth of fungi. Control ponds had the greatest number of phycomycetes and lesser number of ascomycetes than polluted ponds; both types of basins had equal density of fungi imperfecti. A suggestion is made that fungi participate in decomposition of organic matter and aid in purification of waste. (See also W71-06012) (Wilde-Wisconsin)
W71-06013

CHARACTERISTICS OF SPARTINA MARSH WHICH IS RECEIVING TREATED MUNICIPAL SEWAGE WASTES,
North Carolina Univ., Chapel Hill. Dept. of Zoology.
David E. Marshall.
Studies of marine estuarine ecosystems developing with treated sewage wastes. National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 317-356, May 15, 1970. 24 fig, 7 tab, 10 ref.

Descriptors: *Salt marshes, *Sewage effluents, Water pollution effects, Tidal marshes, Estuaries, Nutrients, Decomposing organic matter, Bacteria.
Identifiers: *Calico Creek (NC), *Morehead City (NC), Treated sewage, Spartina alternifolia, Littorina irrorata, Melampus bidentatus.

This study compared an effluent-fertilized and a natural salt marsh through an annual cycle. On the basis of general appearance, the waste receiving marsh in Calico Creek produced a higher biomass of Spartina alternifolia than the natural marsh, thus indicating a beneficial effect of fertilization. The augmented growth of Spartina and its rapid decay were paralleled by a high population of snails, particularly Littorina irrorata. The increased activity of bacteria and rate of decomposition of organic tissues is attributed to the release of nutrients by dead Spartina grass and Melampus snails. No significant difference was detected in the subsurface salinity of the two marshes. (See also W71-06012) (Wilde-Wisconsin)
W71-06014

MOLLUSCAN STUDIES,
North Carolina Univ., Chapel Hill; and North Carolina Univ., Morehead City. Inst. of Marine Sciences.
A. F. Chestnut.
Studies of marine estuarine ecosystems developing with treated sewage wastes. National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 280-286, May 15, 1970. 5 fig.

Descriptors: *Mollusks, *Brackish water, Saline water, Hydrogen ion concentration, Clams, Water pollution effects, Oysters, Model studies.
Identifiers: *Calico Creek (NC), *Morehead City (NC), Treated sewage, Rangia cuneata, Crassostrea virginica, Mercenaria mercenaria, Aequipecten irradians.

The survival of mature clams, Rangia cuneata, indicated the extremely wide amplitude of tolerance of these organisms to reaction of water ranging from pH 3.0 to 10.0. The low salinity precluded the survival of hard clams, Mercenaria mercenaria, and bay scallops, Aequipecten irradians. Particular attention was given to the growth of common oyster, Crassostrea virginica. The mortality of mature oysters in polluted ponds was about 50% higher than that in control ponds. Both the survival and growth rate of oyster spat were appreciably higher in control ponds. (See also W71-06012) (Wilde-Wisconsin)
W71-06015

CRUSTACEANS AND FISHES IN THE SEA GRANT PONDS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Science and Engineering.
Michael D. Beeston.
Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 272-279, May 15, 1970. 6 tab, 1 ref.

Descriptors: *Saline water, *Crustaceans, *Fish, Water pollution effects, Population, Growth rates, Sewage, Model studies.
Identifiers: *Calico Creek (NC), *Morehead City (NC), Treated sewage.

Several methods were used to sample crustaceans and fish in control and sewage-enriched ponds. Large shrimp, Benaeus aztecus and P duorarum, were found only in control ponds; small shrimp, Palaemonetes pugio, and blue crab, Calinectes sapidus, were present in all ponds. Spot, pinfish, croaker, flounder, silversides, and anchovies were found only in the control ponds. Spot was the only species caught in numbers sufficient to estimate its biomass. One of the control ponds harbored Aegathoa oculata, a crustacean parasitizing on anchovies. The fish population of waste ponds consisted largely of minnows, Fundulus heteroclitus being the predominant species. (See also W71-06012). (Wilde-Wisconsin)
W71-06016

CARBON,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
John Day.
In: Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Divsion and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 188-212, May 15, 1970. 19 fig, 5 ref.

Descriptors: *Carbon, *Brackish water, Water pollution effects, Carbon dioxide, Simulation analysis, Computer models, Sediments.
Identifiers: *Calico Creek (NC), *Morehead City (NC), Inorganic carbon, Organic carbon, Total carbon, Treated sewage, Carbon dioxide diffusion.

The ultimate aim of this study is to formulate a model of carbon flow in the system of control and sewage polluted ponds. These reservoirs were supplemented by mixing tanks. The rate of entry and drain were measured to calculate the carbon flux in aqueous phase. Carbon dioxide across the air-water interface was measured with an infrared gas analyzer. The loss of carbon was determined by analyses of sediments. The levels of total, inorganic, and organic carbon were recorded from July through November. Heavy algal blooms in July increased the organic carbon content. Both waste and control ponds showed a gradual decrease in the level of total carbon. The city water, obtained from a limestone aquifer, was very high in inorganic carbon. For most ponds, carbon dioxide diffused out of water almost continuously due to the high content of inorganic carbon in the feed water. (See also W71-06012) (Wilde-Wisconsin)
W71-06017

PHOSPHORUS FLUX BETWEEN WATER AND PLANKTON: A PRELIMINARY REPORT,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering; and North Carolina Univ., Morehead City. Inst. of Marine Sciences.
Edward J. Kuenzler, Henry McKellar, and Barbara Muse.
In: Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 180-187, May 15, 1970. 2 fig, 2 tab, 2 ref.

Descriptors: *Phosphorus, *Cycling nutrients, *Plankton, *Brackish water, Water pollution effects, Sewage, Chemical analysis, Adsorption, Model studies, Radioactivity techniques.
Identifiers: *Calico Creek (NC), *Morehead City (NC), Organic phosphorus, Inorganic phosphorus, Dissolved phosphorus, Mercury chloride, Formaldehyde, Treated sewage.

This investigation considered the effect of domestic wastes upon phosphorus cycling. Radiotracer technique was used to measure the flux of phosphorus from one compartment to another. The content of total phosphorus in waste ponds exceeding at times 60 microgram/liter, was generally much higher than that of control ponds. The relative rate of phosphorus uptake by plankton was directly proportional to particulate phosphorus and inversely proportional to dissolved inorganic phosphorus. The relative uptake rate in minutes and the turnover time in hours were calculated on the basis of the radioactivity of filtrate measured at different time intervals. Poisons, including formaldehyde and mercury chloride, were very efficient at low rates of uptake. (See also W71-06012). (Wilde-Wisconsin)
W71-06018

THE USE OF CARBON-14 FOR THE STUDY OF THE UPTAKE AND UTILIZATION OF PHYTOPLANKTON BY RANGEA CUNEATA,
North Carolina Univ., Morehead City. Inst. of Marine Sciences.
Roy Hyle, III.
In: Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 174-179, May 15, 1970. 6 tab, 5 ref.

Descriptors: *Estuaries, *Phytoplankton, *Mollusks, Clams, Cultures, Laboratory tests, Algae, Feeding rates, Model studies, Absorption, Water pollution effects, Radioactivity techniques.
Identifiers: *Morehead City (NC), *Calico Creek (NC), *Rangea cuneata, Oocystis parva, Nannochloris atomus, Carbon-14, Treated sewage.

The intent of this study is to establish utilization of Oocystis parva and Nannochloris atomus algae by filtering mollusks. Clams, Rangea cuneata, were placed in sea water diluted with distilled water to 15-20 o/oo. A sample of C-14 labelled phytoplankton was drawn and filtered at the beginning and end of feeding period. At the end of the feeding period, the clams were placed in a bowl of multipore filtered water and allowed to pump for several hours. Radioactivity of filters was determined with a Geiger counter and combusted tissue samples were counted with a Dynacon unit. The results suggested uptake and assimilation of algae by clams, but the data did not fit into the uptake-assimilation equations. (See also W71-06012). (Wilde-Wisconsin)
W71-06019

BENTHIC PRODUCTIVITY,
North Carolina Univ., Morehead City. Inst. of Marine Sciences.
Ronald Dillon, and William J. Woods.
In: Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 133-143, May 15, 1970. 4 fig, 3 tab, 3 ref.

Descriptors: *Estuaries, *Benthos, *Productivity, *Water pollution effects, Ponds, Model studies, Phytoplankton, Sewage, Oxygen, Respiration, Light, Chrysophyta, Photosynthesis, Laboratory tests.
Identifiers: *Morehead City (NC), *Calico Creek (NC), Light penetration, Treated sewage.

Benthic productivity was determined by light-dark bottle technique in a simulated estuary of polluted and non-polluted waters. To approach conditions observed in natural estuaries, submersible water pumps were mounted inside the jars. All control and one waste pond exhibited a positive net gross production. On the other hand, two control and two waste ponds showed positive net benthic production. The low productivity of some ponds is attributed to high turbidity and limited circulation coupled with high respiration. The erratic results were caused by many rain squalls during the period of study. The introduction of pumps may have been an additional source of errors. No correlation between light energy and net or gross production of all basins was disclosed. (See also W71-06012). (Wilde-Wisconsin)
W71-06020

STUDIES ON ULVA AND OTHER BENTHONIC MARINE ALGAE RECEIVING TREATED SEWAGE IN PONDS AND IN CALICO CREEK AT MOREHEAD CITY, NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Dept. of Botany.
Charles F. Rhyne, and Max H. Hommersand.
In: Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 112-132, May 15, 1970. 7 fig, 2 tab, 9 ref.

Descriptors: *Cytological studies, *Benthos, *Marine algae, *Estuaries, Saline water, Marine plants, Cultures, Biomass, Salinity, Speciation, Nutrients, Sewage, Model studies.
Identifiers: *Calico Creek (NC), *Morehead City (NC), Treated sewage, Heteromorphic alteration, Ulva, Enteromorpha.

Periodic observations of benthic macroscopic marine algae in Calico Creek (North Carolina) estuary and experimental control and sewage-enriched ponds aimed to elucidate factors influencing germination, growth and reproduction of Ulvaceae. The predominant species included Ulva curvata, Enteromorpha prolifera, and E linza. Germination at the microscopic stage was triggered by temperature from 5 to 15C, whereas further development and reproduction required the minimum of 20C. The normal growth and reproduction of Ulvaceae in ponds were hindered by low salinity (1.8%) and a restricted light penetration. The species of Ulva and Enteromorpha introduced on substrate of oyster and scallop shells disappeared from the ponds by the fifth month. However, a reoccurrence of E prolifera was observed one year after its introduction. Attempts to obtain interspecific hybrids have been unsuccessful. (See also W71-06012). (Wilde-Wisconsin)
W71-06021

PHYTOPLANKTON POPULATIONS: A PRELIMINARY REPORT,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Edward J. Kuenzler.
In: Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-1970, p 94-111, May 15, 1970. 3 fig, 2 tab, 22 ref.

Descriptors: *Brackish water, *Water pollution effects, *Phytoplankton, Model studies, Estuaries, Population, Productivity, Nutrients, Sampling, Municipal wastes, Chlorophyll, Ponds, Sewage.
Identifiers: *Morehead City (NC), *Calico Creek (NC), Nutrient cycles, Chlorophyll a, Species composition, Nannochloris, Nitzschia, Cyclotella, Oocystis, Monodus, Chaetoceros, Treated sewage.

The dynamics of phytoplankton were investigated in three control and three sewage-enriched ponds. The sampling was confined to about 10 cm depth near the centers of the ponds. The dominant species in the control ponds were Nannochloris atomus, Nitzschia frustulum, N closterium, and Cyclotella caspia. The former three species reached density exceeding 100,000 cells/ml with maximum number of cells from June to December. The waste ponds harbored largely Oocystis parva, Monodus spp, Nitzschia closterium, N frustulum, and Chaetoceros gracile; most of these were abundant in fall and early winter, but Monodus bloom was striking in April. Both associations were accompanied by small forms of algae of 1-3 micron dimensions. There was generally a good agreement between the concentration of chlorophyll-a and cell counts in each pond. The composition of algal communities may represent only successional stages in a media which are only 18 months old. (See also W71-06012). (Wilde-Wisconsin)
W71-06022

FIRST YEAR RECORD OF TOTAL METABOLISM OF MARINE PONDS RECEIVING TREATED WASTES,
North Carolina Univ., Chapel Hill; and North Carolina Univ., Morehead City. Inst. of Marine Sciences.
Howard T. Odum, Charles Hall, and Sam C. Casarchia.
Studies of marine estuarine ecosystems developing with treated sewage wastes, National Science Foundation, Sea Grants Project Division and North Carolina Board of Science and Technology, Annual Report 1969-70, p 38-93, May 15, 1970. 7 fig, tab, 5 ref.

Descriptors: *Metabolism, *Marine animals, Photosynthesis, *Saline water, Respiration, Diurnal, Ponds, Aeration, Municipal wastes, Productivity, Interfaces, Ecosystems, Aquiculture, Food chains, Oxygen, Computer programs, Light, Hydrogen ion concentration, Model studies, Sewage.
Identifiers: *Calico Creek (NC), *Morehead City (NC), *Marine ponds, Variables patterns, Aeration efficients, Insolation, Treated sewage.

Diurnal changes in oxygen concentration and corresponding calculated seasonal record of productivity are reported. Study of gas dynamics showed that aeration coefficient was less than 0.05 g carbon dioxide/sq m per hour/atmosphere partial pressure gradient of carbon dioxide. With limited diffusion the oxygen concentration was below 0.1 g/sq meter hour/0.2 atmosphere. The pond temperature followed the weather conditions and the temperature range served as an approximate radiometer for total insolation. The insolation in cal/sq cm was obtained as the difference between the ampere-hour meter readings taken at two intervals. When photosynthesis exceeded respiration, the oxygen reached a level of supersaturation and the reaction turned pH 10. The resulting replacement of carbonate alkalinity by hydroxide alkalinity was nontoxic to waterfowl. (See also W71-06012). (Wilde-Wisconsin)
W71-06023

SEASONAL VARIATIONS OF TEMPERATURE, DRIFT, AND HEAT EXCHANGE IN SURFACE WATERS OFF THE WEST COAST OF SOUTH AMERICA,
Scripps Institution of Oceanography, La Jolla, Calif.; and Instituto Hidrografico de la Armada, Valparaiso (Chile).
Warren S. Wooster, and Hellmuth A. Sievers.
Limnology and Oceanography, Vol 15, No 4, p 595-605, July 1970. 10 fig, 9 ref.

Descriptors: *Water temperature, Heat balance, Water balance, Winds, Advection, Coasts.
Identifiers: Seasonal variation, Drift, Latitude.

Wyrtki's published and unpublished climatological data are used to describe seasonal variations of surface temperature, heat exchange, surface drift, and surface winds along the west coast of South America. Although there are well-marked seasonal and latitudinal changes in the heat flux through the sea surface, the heat flux south of 2S is always positive so that advective processes must play an important role in controlling surface temperature. Some general features of the coastal upwelling regime can be seen in an analysis of heat and water balances, but the fields of current velocity and wind stress are too poorly known for unequivocal quantitative results to be obtained. (Upadhyaya-Vanderbilt)
W71-06094

THERMAL DISCHARGE: A MODEL - PROTOTYPE COMPARISON,
Pacific Gas and Electric Co., Emeryville, Calif. Engineering Research Dept.
For primary bibliographic entry see Field 05B.
W71-06095

DEVELOPMENT OF AN INSTRUMENT FOR MEASURING THE CONCENTRATION OF DISSOLVED OXYGEN IN SEA WATER IN SITU,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 05A.
W71-06104

SANITARY CONTROL OF SHELLFISH IN KOREA,
Environment Control Administration, Cincinnati, Ohio. Water Supply and Sea Resources Program.
C. B. Kelly, R. J. Hammerstrom, J. B. Engle, Seong Jun Kim, and Kyung Man Bae.
Available from NTIS as PB-196 351, $3.00 in paper copy, $0.95 in microfiche. Agency for International Development, Washington, DC, 1968. 104 p, 12 ref.
Identifiers: *Aquaculture, *Korea, *Shellfish, Seafood, *Seafood, Sanitation, *Oysters, Sanitation, United States, Public health, Food control, Fisheries, Microbiology, Contaminants, Water pollution, Gastrointestinal diseases, Infectious diseases.

Report covers the public health aspects of establishing effective oyster production for export to the United States. Includes a review of oyster culture and production, shellfish administration and control activities, shellfish legislation, incidence of enteric diseases, laboratory services, sanitary surveys of oyster areas, research and training needs and control of harvesting.
W71-06110

WATER QUALITY OF THE DELAWARE RIVER ESTUARY, JULY THROUGH DECEMBER 1967,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05A.
W71-06156

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

STUDY AND EXPERIMENTS IN WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
Gulf General Atomic Inc., San Diego, Calif.
For primary bibliographic entry see Field 05D.
W71-06025

SURVEY OF DESALTING PROCESSES FOR USE IN WASTE WATER TREATMENT,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05D.
W71-06042

STUDY OF MASS TRANSFER IN MEMBRANE PROCESSES,
California Univ., Berkeley. Sea Water Conversion Lab.
K. S. Spiegler.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $0.70. Office of Saline Water Research and Development Progress Report No 613, Jan 1971. 74 p, 2 tab, 20 fig, 18 ref, 4 append. OSW Contract 14-01-0001-1295.

Descriptors: Membranes, *Electrodialysis, *Reverse osmosis, *Ion transport, *Semipermeable membranes, *Membrane processes, Desalination, Electrochemistry, Pressure, *Mass transfer.
Identifiers: Water splitting, Streaming potential, Hydrodynamics.

Electrical potential differences across membranes were measured with both an anion-exchange membrane used in electrodialysis and a modified cellulose acetate membrane used in reverse osmosis. These measurements were performed in special apparatus which on the one hand simulated plant conditions hydraulically and electrochemically, and on the other permitted the measurement of a variety of other parameters pertinent to mass transfer (e.g. local current density, effluent concentration and effluent pH in electrodialysis, hyperfiltration rate and hyperfiltrate concentration in reverse osmosis). The results obtained point strongly towards confirmation of the original thesis viz., that electrical measurements can serve as important diagnostic tools in the study and in the control of these desalting methods. (Kindley-Office of Saline Water)
W71-06233

IMPROVEMENT OF THE CORROSION RESISTANCE OF ALUMINUM BRASS FOR USE IN SEA WATER CONVERSION PLANTS,
IIT Research Inst., Chicago, Ill.
For primary bibliographic entry see Field 08G.
W71-06234

Application of Iron-Aluminum Base Alloys to Saline Water Conversion,
Solar, San Diego, Calif.
For primary bibliographic entry see Field 08G.
W71-06235

RESEARCH ON PIEZODIALYSIS - Second Report,
Ionics, Inc., Watertown, Mass.
Frank B. Leitz, Samuel S. Alexander, Dirk M. deWinter, and Charles W. Plummer.
For sale by the SOD, GPO, Wash, DC, 20402, Price $0.65. Office of Saline Water Research and Development Progress Report No 620, December 1970. 66 p, 31 tab, 9 fig. OSW Contract 14-01-0001-611.

Descriptors: *Desalination, Aqueous solutions, Ions, *Ion exchange, Membranes, *Dialysis, *Membrane processes.
Identifiers: *Piezodialysis, Mosaic Membranes, Ion exchange membranes.

Piezodialysis is a promising new, coupled-transport process for desalination of aqueous solutions. In this process a hydrostatic head forces water and ions through regions of ion-exchange resins under conditions where a permeate enriched in salt is obtained. In November 1965 a project was undertaken in the laboratories of Ionics, Incorporated, to investigate some of the conditions

under which practical piezodialysis could occur and to prepare membranes which had intrinsic properties suitable for piezodialysis. The work concentrated on mosaic ion exchange membranes consisting of small regions of anion selective material interspersed with small regions of cation selective material, each such region extending substantially uniformly from one surface of the membrane to the other. Equations were developed for predicting the maximum value of salt enrichment and the maximum allowable current path length from resin transport coefficients. The measured transport properties of several ion-exchange resin formulations were shown to be promising for piezodialysis. Performance of a piezodialysis unit expressed as production rate per unit area and as fractional recovery as product, were found to be strongly dependent on average salt enrichment. While there is too much uncertainty for accurate economic prediction, an average of 5 should make the process roughly competitive with reverse osmosis. Performance of composite membrances from styrenized polyethylene resins gave considerable support to the prediction power of the mathematical analysis. Further work on membrane synthesis led to the development of the latex-polyelectrolyte membrane. With the best example of this type a salt enrichment factor greater than 5 was obtained. (See also W70-05081) (Johnson-Office of Saline Water)
W71-06236

BOUNDARY LAYER FLOW PROBLEMS IN DESALINATION BY REVERSE OSMOSIS,
California Univ., San Diego. Dept. of Aerospace and Mechanical Engineering Sciences.
F. A. Williams, T. J. Hendricks, and M. K. Liu.
For sale by the SOD, GPO, Wash, DC 20402, Price $1.75. Office of Saline Water Research and Development Progress Report No 622, December 1970. 230 p, 11 tab, 89 fig, 65 ref, 4 append. OSW Contract 14-01-0001-951.

Descriptors: *Desalination, *Reverse osmosis, Osmosis, Brines, *Boundary layers, Membranes, *Membrane processes, Separation techniques, *Desalination processes.
Identifiers: Concentration polarization, Boundary layer flow.

Buildup of excess salt concentration in brine adjacent to a reverse-osmosis membrane was studied experimentally and theoretically. An unstirred batch cell and a two-dimensional channel were investigated experimentally by electrical conductivity microprobes and shadowgraph techniques. These two systems and a semi-infinite flat plate were studied theoretically by perturbation methods, series expansion methods, asymptotic analyses, iterative techniques, linearization procedures, transform techniques and integral methods. Rejection-loss and diffusion-wave phenomena were identified theoretically. For the cell, experiments showed each theory holds within theoretically anticipated range of applicability; in an intermediate range of time and of ratio of osmotic to applied pressure, no theory agrees well with experiment. For the channel, experimental membrane salt concentrations agree well with predictions of an integral theory based on the experimentally verified assumption of an exponential excess concentration profile. The new integral theory can be applied easily in design calculations. Experimental observations of buoyant instability (membrane above brine) revealed convection patterns which possess wave lengths of a few millimeters and frequencies of a minute or two, for batch-cell and laminar-channel flow. Observations are correlated by convection-jet model. Buoyant convection greatly reduces average excess concentration and increases membrane flow rates. (Johnson-Office of Saline Water)
W71-06237

ECONOMICS OF COMBINING DISTILLED SEAWATER AND RENOVATED WASTE WATER AS A NEW SOURCE OF MUNICIPAL WATER SUPPLY,
Bechtel Corp., San Francisco, Calif.
J. W. Porter.
For sale by the SOD, GPO, Wash, DC 20402, Price $1.50. Office of Saline Water Research and Development Report No 617, October 1970. 97 p, 12 tab, 16 fig, 6 ref, 5 append. OSW Contract 14-01-0001-2161.

Descriptors: *Desalination, *Cost analysis, *Water reuse, *Evaluation, Model studies, *Municipal water, *Water supply, Waste water treatment, Economies.

A methodology for determining the preliminary economics of combining distilled seawater and renovated waste water to serve as a new source of municipal water supply was investigated and the results are reported. A computational procedure for determining least-cost supply from this combined source and alternative single sources was developed and is documented. The feasibility of the computational procedure (a mathematical model) is tested by application to a hypothetical U.S. coastal city. Appendices to the report include a description of the standard linear programming model (LP-600) used, discussion of the network theory applied, listings of computer sub-routines employed, verification of cost calculations and a list of cited references. (Miller-Office of Saline Water)
W71-06238

ION-SELECTIVE ELECTROCHEMICAL SENSORS,
Texas Instruments Inc., Dallas.
Isaac Trachtenberg, and Charles T. Baker.
Copy available from GPO Sup Doc, Wash, DC 20402, Price $1.00. Office of Saline Water Research and Development Progress Report No 496, December 1969. 105 p, 3 tab, 51 fig, 2 append. OSW Contract 14-01-0001-1737.

Descriptors: *Electrochemistry, *Analytical techniques, *Ions, Saline water, *Electrodes, Iron.
Identifiers: Ion selective electrodes, Non-oxide glass sensors, *Electrochemical sensors.

Several ion-selective electrochemical sensors prepared during the course of this research program have shown selective response to specific ions. The Fe (.....) sensors are the most promising sensors in this study. A chalcogenide glass (TI No 1173 - 28% Ge, 60% Se, 12% Sb) was doped with various amounts of Fe and Fe compounds. Sensors produced from this material yielded very selective response to Fe (.....), even in the presence of Fe (....). Response has been observed at concentrations as low as 0.000001 moles/liter (0.056 ppm). The preferred working range is 0.00001 to 0.01 moles/liter. The sensor has maintained its selectivity after five months in solution. The ability to reproduce the sensor has also been established. (See also W71-06240)
W71-06239

ION-SELECTIVE ELECTROCHEMICAL SENSORS - SECOND REPORT,
Texas Instruments Inc., Dallas.
Issac Trachtenberg, and Charles T. Baker.
For sale by the SOD, GPO, Wash, DC, 20402, Price $0.75. Office of Saline Water Research and Development Progress Report No 619, December 1970. 59 p, 32 fig, 3 tab, 10 ref, append. OSW Contract 14-01-0001-1737.

Descriptors: *Electrodes, *Analytical techniques, *Ions, Saline water, *Alkaline earth metals, Calcium, Magnesium, Metals, Electrochemistry, Iron, Sodium, Potassium, Sulfates.
Identifiers: Ion-selective electrodes, Non-oxide glass sensors, Solid state sensors, *Electrochemical sensors.

This is the second report on the ion-selective electrochemical sensor program; the first report was made in OSW R and D Progress Report No. 49 (See W71-06239). For the doped-1173 glass F (.....) sensors, the redox potential for the reducin agent in the glass has been bracketed between 0.12 V and ..0.18 V. In addition, activation exper ments revealed that the deterioration of potenti response with time is related to a surfac phenomenon (probably film formation). The varia tion in the rate of deterioration from one glass sam ple to the next was related to alterations in th preparation procedures. Simple chemical and/o mechanical treatment of the surface can restore th sensor almost to its original condition. Develop ment of solid state sensors for Ca (....) is anothe accomplishment made during this reporting period Of this group, the 10% YF3-CaF2 polycrystallin membrane sensor exhibited the most favorabl potential response characteristics, displaying theoretical Nernst response to the divalent cation of the alkaline earth metals (Ca (....), Mg (....), an Ba (....)). To the monovalent cations and othe divalent cations, the potential response was les than theoretical. The selectivity of the present sen sors will limit their application to certain systems When the ratio of divalent alkaline earth catio concentration to monovalent or other divalent ca ion concentration was S0.1, little interference wa noted. With higher interfering ion concentrations however, the response to the alkaline earth catio was retarded or eliminated. This is the same type o problem which plagues so many of the currentl commercially available ion-selective electrodes (Horowitz-Office of Saline Water)
W71-06240

FIRST ANNUAL REPORT - OPERATION OF THE MULTI-EFFECT MULTI-STAGE FLASH DISTILLATION PLANT (CLAIR ENGLE), SAN DIEGO, CALIFORNIA.
Catalytic Construction Co., Philadelphia, Pa.

For sale by the SOD, GPO, Wash, DC, 20402, Price $3.25. Office of Saline Water Research and Development Progress Report No 596, November 1970. 282 p, 48 tab, 55 fig, 4 append. OSW Contract 14-01-0001-1297.

Descriptors: Operations and maintenance, Management, *Flash distillation, *Desalination, Development, *Desalination equipment, Heat exchangers, Pumps, Corrosion, Water treatment, Deaeration, Evaporators, Operating costs, Design, Scaling, *Desalination plants.
Identifiers: High temperature operation.

This document contains a general discussion concerning the management, operation, maintenance, physical plant, and information gained in the overall program of advancing the state of the art of desalting technology. The plant is a 1,000,000 gallon per day, high performance, sea water desalination plant. The plant is designed to provide meaningful data concerning the design and operation of large desalination plants including such items as heat transfer, equipment and structural design, materials, cost of providing fresh water, process engineering including high temperature operation, operation of multi purpose plants, and equipment performance. (See also W71-06242) (Lohman-Office of Saline Water)
W71-06241

SECOND ANNUAL REPORT - OPERATION OF THE MULTI-EFFECT MULTI-STAGE FLASH DISTILLATION PLANT (CLAIR ENGLE), SAN DIEGO, CALIFORNIA.
Catalytic Construction Co., Philadelphia, Pa.

For sale by the SOD, GPO, Wash, DC 20402, Price $1.75. Office of Saline Water Research and Development Progress Report No 629, November 1970. 229 p, 25 tab, 32 fig. OSW Contract 14-01-0001-1803.

Descriptors: Operations and maintenance, Management, *Flash distillation, *Desalination, Development, *Desalination equipment, Heat

changers, Pumps, Corrosion, Water treatment, eaeration, Evaporators, Operating costs, Design, aling, *Desalination plants.
entifiers: High temperature operation.

is document contains a general discussion con-rning the management, operation, maintenance, ysical plant, and information gained in the erall program of advancing the state of the art of salting technology. The plant is a 1,000,000 gal- per day, high performance, sea water desalina- n plant. The plant is designed to provide eaningful data concerning the design and opera- n of large desalination plants including such ms as heat transfer, equipment and structural sign, materials, cost of providing fresh water, ocess engineering including high temperature eration, operation of multi purpose plants, and uipment performance. (See also W71-06241) ohman-Office of Saline Water)
71-06242

K RIDGE NATIONAL LABORATORY VER-CAL TUBE EVAPORATOR PILOT PLANT NUAL REPORT FOR FISCAL YEAR 1969.
arns-Roger Corp., Denver, Colo.

sale by the SOD, GPO, Wash, DC, 20402, ce $1.00. Office of Saline Water Research and velopment Progress Report No 600, August, 70. 58 p, 14 tab, 12 fig, append. OSW Contract 01-0001-2535.

scriptors: Distillation, *Evaporators, *Conden-, *Heat transfer, *Desalination processes, esalination plants.
ntifiers: Falling film evaporation, Spray nozzles.

ummary is presented of the down-flow heat nsfer performance of enhanced surface tubes operations at the four-effect Vertical Tube porator Pilot Plant at the Office of Saline Water t Coast Test Station, Wrightsville Beach, North olina. The time period is from July 1, 1968 to e 30, 1969. Average overall heat transfer coeffi-ts in the range of 1300-2100 Btu/hr. deg F sq ft e observed for double-fluted tubes during ained runs. Summaries of overall heat transfer fficients show deterioration, presumably from ing tube surfaces, for selected data runs. Tube ace cleaning is shown to restore heat transfer ormance to clean or original levels. For each ct, overall heat transfer coefficients of the anced surface tubes appear to be related to e feed rate, expressed as evaporating brine flow nolds number. Overall heat transfer coeffi-ts for each effect are shown to be related to the perature level in each effect. Temperature ations in heat transfer coefficients can also be essed in terms of brine Reynolds number. A eral correlation for overall heat transfer coeffi-t, expressed as a function of brine Reynolds ber, appears to predict flow and temperature ations in coefficients. Down-flow coefficients shown to be essentially the same as up-flow ficients. Operation problems encountered dur-he period are discussed. The acid injection and tic neutralization system was used to control leaerator-decarbonator exit pH to an average f 6.7 with a maximum deviation for any run of or minus .5 pH units. Dissolved oxygen levels measured with Magna and Beckman oxyme-which were calibrated with Winkler tests. (See W71-06244) (Callahan-Office of Saline er)
-06243

RIDGE NATIONAL LABORATORY VER-AL TUBE EVAPORATOR PILOT PLANT - UAL REPORT FOR FISCAL YEAR 1970.
ns-Roger Corp., Denver, Colo.

sale by the SOD, GPO, Wash, DC, 20402, $1.25. Office of Saline Water Research and lopment Progress Report No 618, October 158 p, 13 ref. OSW Contract 14-01-0001-

Descriptors: Distillation, *Evaporators, *Condensers, *Heat transfer, Desalination processes, *Desalination plants.
Identifiers: Falling film evaporation, Spray nozzles.

Two long tube vertical falling film sea water evaporator pilot plants were operated at the Office of Saline Water, Wrightsville Beach Test Facility, Wrightsville Beach, North Carolina, during the period of July 1, 1969 thru June 30, 1970. The purpose of their operations was to produce accurate design data concerning heat transfer performance of enhanced surface evaporator tubes. Heat transfer coefficients at least twice smooth tube values, at similar conditions, was seen. Also performance was seen to vary directly with tube feed brine flow and inversely with antifoam level in the brine. The presence of surfactant marginally increased performance at high injection levels. The four effect train operated easily and successfully on the sump to sump mode of brine transfer. A multiphase ejector vapor compression pilot plant was completed and was ready for development testing at the end of the period. (See also W71-06243) (Callahan-Office of Saline Water)
W71-06244

SURVEY OF DESALTING PROCESSES FOR USE IN WASTE WATER TREATMENT,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05D.
W71-06268

3B. Water Yield Improvement

LAKE CHAMPLAIN IN RELATION TO REGIONAL WATER SUPPLY,
Vermont Univ., Burlington. Dept. of Zoology.
E. B. Henson, and Milton Potash.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 441-448, 1969. 8 p, 5 fig, 1 tab, 3 ref. OWRR Project A-014-VT (1).

Descriptors: *Water balance, *Water sources, *Water resources development, *Lakes, *New York, Water management (Applied), Water supply, Discharge (Water), Water yield.
Identifiers: *Lake Champlain (NY-Vt).

Lake Champlain is a deep glacial lake of the St. Lawrence drainage. It is the easternmost major contributor of fresh water to the St. Lawrence system before the St. Lawrence becomes brackish. Because of its large size (440 sq mi) and considerable depth (400 ft), Lake Champlain has been singled out as a potential regional water supply for the metropolitan areas of New England and New York City. An analysis has been made of the water budgets of the Lake to ascertain its reliability as a major water supply. The lake's outlet, the Richelieu River, has a mean outflow of 11,000 cfs, equivalent to 38% of the lake volume. The flow-through period amounts to only 2.6 years. Total input ranges from 25% to 55% of the lake volume, and the input correlates very closely with outflow, implying rapid displacement and short-term storage. Present municipal water use of the Lake amounts to 1% of the lake volume per year. Lake levels are usually at low stages when regional demands for water are greatest. It is recommended that water resource planners look to the more stable supplies of the Lake Ontario discharge as a reliable source of water or the region. (See also W71-05561) (Knapp-USGS)
W71-05875

RURAL WATER DISTRICTS--HERE IS WHY THEY ARE NEEDED,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 06B.
W71-06061

SEVENTH BIENNIAL CONFERENCE ON GROUNDWATER (PROGRESS, PRACTICE, AND POTENTIAL OF GROUNDWATER RECHARGE, DEVELOPMENT AND MANAGEMENT).
For primary bibliographic entry see Field 04B.
W71-06117

POTENTIAL FOR STREAMFLOW AUGMENTATION BY GROUNDWATER PUMPING,
Miami Conservancy District, Dayton, Ohio.
For primary bibliographic entry see Field 04B.
W71-06118

OPPORTUNITIES FOR MODIFYING WEATHER TO AUGMENT PRECIPITATION AND SUPPRESS HAIL,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
Lewis O. Grant.
In: Frontiers in Conservation, Proceedings 24th Annual Meeting Soil Conservation Society of America, August 10-13, 1969, Colorado State University, Fort Collins, p 76-82, 1970. 7 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Artificial precipitation, *Cloud seeding, *Precipitation (Atmospheric), *Colorado River Basin, Model studies, Water yield, Methodology, Rainfall, Hail, Clouds, Cloud cover, Meteorology, Climatology, Orography, Silver iodide, Coalescence.
Identifiers: Dry ice, Ice crystals.

Physical models have been developed that define conditions under which cloud seeding should have varying effects from artificial seeding of cold orographic clouds. The results of randomized artificial seeding experiments verify the conclusion that substantial increases in precipitation should be achieved when coldest cloud temperatures are in the range from about minutes 13 deg to minus 20 deg centigrade and that decrease might result when cloud temperatures are colder than about minus 26 deg centigrade. By considering the increases expected for cloud temperatures of minus 20 deg centigrade and warmer and the frequency of such occurrences in the Colorado River Basin, it is estimated that overall precipitation increases during the winter snowpack season should be 10 to 12% in the central and northern portions of the basin and 32 to 36% in the San Juan area of the southern portion of the basin. The investigations that have been carried out provide guidelines for conducting operational seeding for this type of cloud. (See also W71-06129) (Woodard-USGS)
W71-06132

THE SURFACE INSTRUMENT NETWORK OF THE UPPER COLORADO RIVER PILOT PROJECT,
Western Scientific Services, Inc., Fort Collins, Colo.
For primary bibliographic entry see Field 07A.
W71-06136

WATER CONSERVATION BY REMOVAL OF PHREATOPHYTES,
Geological Survey, Tucson, Ariz.
Richard C. Culler.
EOS, Transactions, American Geophysical Union, Vol 51, No 10, p 684-689, October 1970. 6 p, 11 fig, 6 ref.

Descriptors: *Phreatophytes, *Brush control, *Evapotranspiration control, *Water utilization, Land clearing, Water conservation, Flood plains, Land use, Watershed management, Hydrologic budget, Groundwater movement, Wildlife habitats.
Identifiers: *Gila River (Ariz.).

Evapotranspiration from the flood plain of a major river depletes water that otherwise might be available to downstream users. Removal of phreatophytes and replacing them with grasses hav-

ing a lower consumptive use can result in higher beneficial use of water, particularly in arid regions. Benefits of added grass as forage must be compared with the loss of brush as a wildlife habitat. Comparative data are presented from a study of the Gila River flood plain, Arizona, begun in 1963. Actual evapotranspiration is computed by the water-budget method. Instrumentation is described, and surface water and groundwater budgets are shown graphically. The computed evapotranspiration for 1964 is higher than for 1967. The average for the period used in this paper is 26,000 cu m (21 acre-feet) per day for 1964 and 16,000 cu m (13 acre-feet) per day for 1967, indicating that the water conveyance efficiency of the flood plain alluvium was improved by removing the brush. (Lang-USGS)
W71-06154

3C. Use of Water of Impaired Quality

EFFECT OF TIME OF EXPOSURE TO SALINITY ON GROWTH, WATER STATUS AND SALT ACCUMULATION IN BEAN PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ. Jerusalem (Israel).
For primary bibliographic entry see Field 02I.
W71-06074

SALINE ARTESIAN WATER AS A SUPPLEMENT,
Geological Survey, Miami, Fla.
Frederick W. Meyer.
Journal of the American Water Works Association, Vol 63, No 2, p 65-71, February 1971. 7 p, 10 fig, 9 ref.

Descriptors: *Water resources development, *National parks, *Florida, *Saline water, *Artesian wells, Confined water, Water quality, Salinity, Water chemistry, Hydrogeology, Water sources, Groundwater movement, Aquifer characteristics.
Identifiers: *Everglades National Park (Florida).

Large quantities of moderately saline water (less than 5,000-mg/liter dissolved solids) can be obtained from artesian water-bearing zones in the Avon Park Limestone of Eocene age--the top of which occurs at a depth of about 1,200 ft in southern Florida. Small quantities of less saline water can be obtained from artesian water-bearing zones in the Hawthorn, Tampa, and Suwannee Formations between 300 and 1,100 ft in depth. Artesian water could be used for small desalting plants in the Florida Keys and the Coastal Lowlands area at considerable savings over using sea water. The use of raw artesian water from below 1,300 ft for dry-weather biologic survival ponds in the Everglades, such as in the Everglades National Park, is infeasible because the salinity is too high for some species of plants and animals. Generally, piezometric levels, salinities, and flows increase with depth in southern Florida. (Knapp-USGS)
W71-06124

WATER USE BY COTTON FROM LOW AND MODERATELY SALINE STATIC WATER TABLES,
Agricultural Research Service, Weslaco, Tex., and Texas Agricultural Experiment Station, College Station.
L. N. Namken, C. L. Wiegand, and R. G. Brown.
Agronomy Journal, Vol 61, No 2, p 305-310, 1969. 4 tab, 4 fig, 11 ref

Descriptors: *Consumptive use, *Lysimeters, *Saline water, *Water table, *Cotton, *Water conservation, Capillary action, Salinity, Groundwater, Moisture uptake, Water use, Crop production.
Identifiers: Irrigated crop

Moderately saline static water tables occur in the semi arid and arid southwestern United States, and reduce irrigation needs. A 4-year lysimeter study determined the contribution of shallow saline water on cotton yields on permeable soils. Controlled water tables at 91-, 183-, and 274-cm contributed 54.4, 26.4, and 17.3% of total water used under high-moisture treatment, and 60.6, 48.9, and 39.2% under low-moisture treatment. Soil profile depletion, rainfall, irrigations, and water-table additions comprised the total water. Water uptake from the 274-cm table was strongly related to capillary-zone salinity. Lint yields were related to total water and capillary-zone salinity. Moderate capillary-zone salinity (EC of 10 to 14 mmhos/cm) reduced monthly and seasonal water use compared with low salinity (EC of 2 to 3 mmhos/cm). High-moisture treatment delayed seasonal water use. Tables show moisture and water-table influences, and rainfall distribution. Figures show salinity and water-use distribution, monthly water table, and relation between cotton lint yields and water use. (Popkin-Arizona)
W71-06221

3D. Conservation in Domestic and Municipal Use

WATER RESOURCES OF NASSAU AND SUFFOLK COUNTIES,
Holzmacher, McLendon and Murrell, Melville, N.Y.
S. C. Mclendon.
Water and Sewage Works, Vol 118, No 2, p 34-36, February 1971. 3 p.

Descriptors: *Water resources development, *New York, *Groundwater, Water yield, Safe yield, Water quality, Water pollution sources, Nitrates, Aquifers, Water supply, Saline water intrusion.
Identifiers: *Long Island (NY), Nassau County (NY), Suffolk County (NY).

Water resources studies have been underway for some time and are nearing completion for both the Long Island, New York counties of Nassau and Suffolk. There is much similarity between the two counties with respect to water supply. The major differences appear in the eastern region of Suffolk County and to a lesser extent, in southwestern Nassau County. In Suffolk County, the estimated permissive sustained yield is 466 mgd. It is predicted that four of the ten towns in Suffolk County will have deficits before 2020. These are Babylon, Riverhead, Southold and East Hampton. A high percentage of the total permissive sustained yield could be withdrawn from the Magothy formation and will be necessary where Glacial supplies are not present or where the Glacial cannot be utilized because of unacceptable water quality. The widespread detection of detergents in the shallow formations in southern Nassau County and southwestern Suffolk County, and the more recent significant increases in nitrate concentrations in wells along the central portion of Nassau and western Suffolk, show that the population is polluting its drinking water supply. When the water supply quality is preserved, so is the water supply quantity. (Knapp-USGS)
W71-05843

3E. Conservation in Industry

REGENERATION OF THE SEVAN,
Army Foreign Science and Technology Center, Charlottesville, Va.
For primary bibliographic entry see Field 02H.
W71-06330

3F. Conservation in Agriculture

DEVELOPMENT OF WATER RESOURCES IN ASIA AND THE FAR EAST-REPORT OF THE NINTH SESSION OF THE BIENNIAL REGIONAL CONFERENCE ON WATER RESOURCES DEVELOPMENT.
Economic Commission for Asia and the Far East (UN), New York.
For primary bibliographic entry see Field 06B.
W71-05864

UREA CONVERSION TO AMMONIA IN WATERLOGGED SOILS,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W71-05866

A PROGRAMMING MODEL FOR FARM IRRIGATION SYSTEMS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
James. S. Windsor, and Ven Te Chow.
Civil Engineering Studies, Hydraulic Engineering Series, No 23, (UILU-ENG-71-2003), December 1970. 95 p, 15 tab, 6 fig, 14 ref, 3 append. OWRR Project B-030-ILL (3).

Descriptors: *Irrigation systems, *Optimization, *Linear programming, *Dynamic programming, Planning, Irrigation, Irrigation efficiency, Computer programs.

This report describes the development of a programming model for farm irrigation systems. In the model, a multi-crop, multi-soil, farm irrigation system is broken down into a number of discrete units, and then analyzed by means of a two-level optimization approach. Dynamic programming is used at the first level of optimization and linear programming at the second level of optimization. To show how the procedure may be set up on a computer, a hypothetical two-crop, two-soil, farm irrigation system is analyzed considering several resource combinations.
W71-05923

PHYSIOLOGY OF BOLL SHEDDING IN COTTON: IV. CORRELATION STUDIES ON FLOWER PRODUCTION AND BOLL SHEDDING IN RELATION TO TEMPERATURE AND RAINFALL,
Indian Agricultural Research Inst., New Delhi.
S. N. Bhardwaj, P. N. Sharma, and R. B. Mehra.
Indian Journal of Agricultural Science, 1968, Vol 38, No 4, p 747-752. 4 tab, 1 fig, 5 ref.

Descriptors: *Cotton, *Crop production, *Plant physiology, *Flowering, Temperature, Rainfall, Analysis, Varieties.
Identifiers: *Boll shedding.

Wide temperature and rainfall fluctuations occur in the northern cotton-growing tract of India as flowering in hirsutum varieties extends from July to mid-October. Flowering and boll shedding have similar distinct peaks. Analysis of the effects of temperature and rainfall on flower production and boll shedding was made at weekly intervals in 4 hirsutum varieties. Flowering and shedding were found to be governed by interrelated internal and external factors. Flower production is governed by maximum and minimum temperatures and rainfall. Moderate rainfall and mean maximum temperature (28 to 33C) were most conductive for flowering. Boll shedding is related to the number of flowers produced. (Popkin - Arizona)
W71-06056

HOW TO SELECT AND APPLY ZINC FERTILIZER,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
R. C. Sorensen, E. J. Penas, and A. D. Flowerday.
Quarterly Serving Farm, Ranch and Home, Vol 17, No 1, Spring 1970, p 9-11. 5 fig.

Descriptors: *Fertilizers, *Calcareous soils, *Nebraska, *Application methods, *Soil-water-plant relationships, Carriers, Nutrients, Distribu-

on, Inorganic compounds, Organic compounds, nelation, Leaching, Soil management, Climates, osts, Soil erosion, Sierozems, Lime, Crop produc- on, Acid soils, Oraganic matter.
entifiers: *Zinc, Semi-arid lands.

ldition of zinc fertilizer to soils of low soil organic atter, high soil pH, lime-rich soil, and low soil ic can increase crop yield. Semi-arid calcareous ils in irrigation-leveled or badly eroded sites in estern Nebraska are improved by zinc fertilizer. ough many fertilizers are available, soluble and ely-grained ones give even distribution and are ost effective. Zinc fertilizers include organic che- es, organic non-chelates, soluble inorganics, and oluble inorganics as carriers. Organic chelate s the best movement characteristics, though ier carriers are effective if mixed with soil on ap- cation. Cost, climatic and management factors, ier nutrient needs, application methods and car- r selection are outlined. Selection of the proper tilizer depends primarily on distribution, mobili- and cost. Figures show corn response to zinc fer- zation, influence of particle size, placement and bility, and distribution of 4 types of fertilizer in a ched soil column. (Popkin - Arizona)
71-06059

ANTING CORN IN NATIVE SOD,
braska Univ., Lincoln. Agricultural Experiment tion.
E. Lane, and L. R. Robison.
arterly Serving Farm, Ranch and Home, Vol 17, 1, Spring 1970, p 12-13. 2 fig, 4 tab.

scriptors: *Planting, *Pasture management, rosion control, *Continuous farming, *Corn eld), Soil management, Stabilization, Brush con- , Herbicides, Grasses, Arid lands, Irrigation er, Soil erosion, Wind erosion, Nebraska, getation establishment, Crop production.
ntifiers: Sand hills, Cole sod planter, Native sod, quat, Atrazine.

continuous vegetation cover is needed in the braska Sandhills because wind will erode the , even while irrigation water is applied. This blem is common to arid lands. Corn grown in ss that has top grass killed gives a continuous p cover to prevent soil erosion. This is beneficial ight soils where spring and fall pasture could be d while corn becomes ensilage. Parquat- and zine-herbicide use and non-use produced ps, but the grassy control inhibited a good corn p. Three pounds of atrazine and 1 pound of aquat produced 18 bushels per acre more than 3 nds atrazine and 1/2 pound paraquat, and 19 hels per acre more than 3 pounds atrazine and pound paraquat. Yields were comparable to ventional corn production. This approach is mising to wind-erodable areas. (Popkin - zona)
1-06060

GRADATION OF WATER QUALITY IN IR- ATION RETURN FLOWS,
ert S. Kerr Water Research Center, Ada, Okla.; Oklahoma State Univ., Stillwater. Dept. of onomy.
es P. Law, Jr., J. M. Davidson, and Lester W. d.
ahoma Agricultural Experiment Station, Bul- B-684, October 1970. 26 p, 9 tab, 7 fig, 27 ref.

criptors: *Irrigation water, *Return flow, ainage water, *Deterioration, *Water pollution cts, Water quality, Salinity, Groundwater, Dis- ed solids, Leaching, Salt balance, Percolating er, Pollution identification, Soil water, Saline er, Water conservation, Irrigation practices.
tifiers: *Salt water irrigation, Salt transport.

object was to determine water-quality adation in irrigation return flows, to determine ity status of a salt-water-irrigated clay loam and to relate these results to irrigation returns surface and groundwater quality. Total dissolved solids (TDS) increased 20% in the surface return flow, while percolating soil water increased 5 to 8 fold in TDS. The clay loam soil showed an increase in soluble salt after 15 years of high-salt-water irrigation (TDS of 1,430 ppm), though leaching by rain contributed a favorable salt balance. Percolating irrigation water transports about 10 tons of salt per acre-foot. Draining and percolating waters adversely affect surface and groundwater. Future studies will consider seasonal fluctuations and dynamics of soil water quality and quantity. Tables show water-table depths, water-sampling locations, schedule of operations, quality data of irrigation, drainage and groundwater, and estimated nutrient losses. Figures show salt content at time and depth of water. (Popkin - Arizona)
W71-06063

A COMPARISON OF WATER USE FOR HYBRID CORN IN THE BEKAA AND THE COASTAL PLAIN,
Agricultural Research Inst., Tal-Amara (Lebanon). Dept. of Irrigation.
A. Aboukhaled, and S. Sarraf.
Magon Institut de Recherches Agronimiques, Serie Technique, Publication No 12, Juin, 1970. 14 p, 3 fig, 5 tab, 8 ref.

Descriptors: *Lysimeters, *Corn (Field), *Soil moisture, *Evapotranspiration, *Irrigation efficiency, Semiarid climates, Evaporation, Solar radiation, Tensiometers, Moisture tension, Climatic data, Pans, Plant growth, Wind velocity, Water requirements, Temperature, Root systems, Moisture availability, Crop response, Advection.
Identifiers: *Lebanon, *Potential evapotranspiration, *Agroclimatology, *Moisture extraction, *Relative humidity, Class A pan, Neutron probes.

The water requirements of a hybrid corn (UH 146) were studied and compared in 2 major Lebanese agricultural areas, the central Bekaa Plain and the Northern Coast Plain (Abde). The prevailing climatic conditions (1969) in the 2 areas were compared in terms of potential evapotranspiration (PET), evaporation (E), solar radiation (R), relative humidity (RH) and wind velocity, and these were correlated with corn water use as measured by lysimeters. At the Abde site, planting occurred 1 month earlier (April) because of known climatic differences. Fertilizer applications were identical at the two sites. At the Bekaa site, 4 differing latin-square designed water schedules were applied on the basis of: (1) Readily available water in the root zone (2) Rate of water use (3) Soil moisture tension at 30 and 60 cm depth (4) Critical growth stages (tasseling to milk stage). The results showed that for similar yields, water use at Abde was about 60% of that in the Bekaa, with peak use reaching 7 mm/day at Abde and 11 mm/day at the Bekaa. The coastal water economy is due to the earlier planting, shorter growing cycle (20 days) and lower evaporative demand, resulting from an average 28% higher RH, 25% low R intensities and reduced wind velocities. In both areas corn water use exceeded measured PET during the critical growth period. The corn ET/class A pan E ratio was higher at the Bekaa due to advection on taller plants. About 4/5 of the total corn root moisture extraction occurred in the top 60-70 cm. soil layer. On the basis of this data, appropriate irrigation schedules are discussed for the 2 areas. (Casey - Arizona)
W71-06067

EFFECTS OF IRRIGATION INTENSITY AND NITROGEN LEVEL ON THE PERFORMANCE OF EIGHT VARIETIES OF UPLAND COTTON, GOSSPYIUM HIRSUTUM L.,
Arizona Agricultural Experiment Station, Yuma.
E. B. Jackson, and P. A. Tilt.
Agronomy Journal, Vol 60, No 1, p 13-17, 1968. 8 tab, 2 fig, 16 ref.

Descriptors: *Cotton, *Irrigation effects, *Nitrogen, *Plant growth regulators, *Irrigation efficiency, Crop production, Arizona, Soil moisture, Moisture uptake, Fibers (Plant), Fertilizers, Consumptive use.
Identifiers: *Lint.

Effects of 4 irrigation treatments and 2 nitrogen levels on performance of 8 upland cotton varieties were studied over a 3-year period on Glendale silty clay loam at Yuma, Arizona. Acala 44-10, Deltapine Smooth Leaf, DeKalb 220, Stoneville 7A, California Strains A and A-65, and Arizona Experimentals 221 and 6010 responded similarly to irrigation treatments. Highest yields were obtained under 14- to 21-day irrigation spacings with totals of 102 to 119 cm of water per season. 'Dry' irrigation treatments approached available soil moisture depletion before each irrigation and produced much lower yields for totals of 84.84 and 64 cm of water. Nitrogen (ammonium sulfate) treatments were most effective at 224 Kg N/ha with 14- to 21-day irrigations. No consistent treatment effect was found on lint percentage on fiber products. Tables show irrigation treatments and effects, statistical significance, and nitrogen effects and interaction. (Popkin - Arizona)
W71-06068

FORMATION OF THE THERMAL REGIME IN SOILS ON IRRIGATED FIELDS IN PERMAFROST REGIONS,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrotekhniki i Melioratsii, Yakutsk (USSR).
For primary bibliographic entry see Field 02G.
W71-06070

THE WOODSMAN'S ASSAULTS ON THE DOMAIN OF THE CATTLEMAN,
Kansas Univ., Lawrence. Dept. of Geography.
Walter M. Kollmorgen.
Association of American Geographers, Annals, Vol 59, No 2, p 215-239, June 1969. 2 fig, 123 ref.

Descriptors: *Arid lands, *Land use, *Water resources development, *Federal government, Great Basin, Great Plains, Deserts, Legal aspects, Social aspects, Economic impact, Irrigation programs, Dry farming, Vegetation effects, Grazing, Desert Land Act, Weather modification, Grasslands, Environmental effects, Land management, Rainfall, Fallowing, Institutional constraints.
Identifiers: *Western U.S., *Cattle ranching, *Geographic perception, *Land alienation, Preemption Act, Homestead Act, Timber Culture Act, Kineaid Act, Enlarged Homestead Act, Stock-Raising Homestead Act.

The open, arid lands of the western U.S. were originally settled by large cattle operators. This land use ethic came into conflict with the cultural and social values of the eastern U.S. woodsman mentality, which in turn led to a century-long series of assaults by the woodsman on the cattleman's domain. The cattleman's survival was then determined by the extent to which he perjured himself and circumvented the intent and institutions of the woodsman, particularly as expressed by a series of congressional land alienation laws. The priori assumptions underlying the woodsman's position were: (1) Congressional incapability in dealing with western land problems, (2) cultural conflict, in which the ethic of small, family farm crop operations took precedence over large, partly nomadic operations and (3) geographic perceptions colored by eastern conditions which lead to misconceived land management attempts, abetted by congressional legislation, that proved inoperative in arid region grasslands. As examples of geographical ignorance, 3 major fallacious water supply concepts gained great currency at differing times and led to tragically misconceived programs. These include the theory that tree-planting increases areal rainfall, that irrigation was a panacea for widespread crop introduction and that dry land farming through fallowing was realistic. It is argued that such misconceptions still color our western land use policies and that governmental attempts to deal with the problem, even now, as in the past, result in confusion and chaos. (Casey - Arizona)
W71-06072

WATER QUALITY MANAGEMENT PROBLEMS IN ARID REGIONS.
Robert S. Kerr Water Research Center, Ada, Okla. Treatment and Control Research Program.
For primary bibliographic entry see Field 05G.
W71-06111

PROBLEMS OF POLLUTION OF IRRIGATION WATERS IN ARID REGIONS,
Utah State Univ., Logan, Dept. of Agricultural and Irrigation Engineering; and Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W71-06112

YIELD REDUCTION BY CONTROLLED FLOODING OF CORN,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
W. F. Ritter, and C. E. Beer.
Americal Society of Agricultural Engineers Transactions, Vol 12, No 1, p 46-47, 50, 1969. 3 p, 1 fig, 2 tab, 6 ref. OWRR Project A-002-IA (3).

Descriptors: *Soil-water-plant relationships, *Crop response, *Corn (Field), *Flood damage, Experimental forms, Agriculture, Crop production, Fertilizers, Nitrogen compounds, Plant growth, Irrigation effects, Growth rates, Growth stages, Floodwater, Saturation, Test procedures, Irrigation practices.
Identifiers: *Controlled flooding, *Iowa State University.

An experiment was conducted at Iowa State University to evaluate flood damages to corn that was inundated for variable periods of time at different stages of growth. The controlled-flooding experiment was conducted on a floodplain soil with a permeable subsoil. Corn was inundated for 24, 48, and 72 hours, with approximately 6 inches of water maintained on the soil surface. Flooding treatment was applied when the corn was about 6 inches high, 30 inches high, and at the silking stage. Two different levels of nitrogen fertility were used on the plots. Results show that corn yields are affected most when flooding occurs at the early stage of growth (6 inches or less). The high-nitrogen and low-nitrogen plot yields were reduced by 20 and 35 percent, respectively, when the plots were inundated for 72 hours. There was also some reduction in yield after only 24 hours of flooding. At later stages of growth, there was little effect on flooding, except on the low-nitrogen plots flooded at the 30 inch height where yields were reduced by about 15 percent after inundation for 72 hours. (Woodard-USGS)
W71-06152

ESTABLISHMENT OF PERENNIAL FORAGES: I. SUBSEQUENT YIELDS; II. SUBSEQUENT ROOT DEVELOPMENT,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Buxton, and W. F. Wedin.
Agronomy Journal, Jan-Feb 1970, Vol 62, No 1, Pt I, p 93-97; Pt II, p 97-100. 6 tab, 6 fig, 37 ref. Iowa Agricultural Journal Papers No J-6270 and J-6274.

Descriptors: *Forages, *Crop production, *Root development, *Plant groupings, *Weed control, Plant growth regulators, Soil-water-plant relationships, Growth rates, Weeds, Oats, Carbohydrates, Solar radiation, Alfalfa, Harvesting, Soil moisture, Fertility, Legumes, Rhizomes, Nutrients, Competition.
Identifiers: Sowing, Planting time, Root weights, Crownvetch, Birdsfoot trefoil.

This research examines the effects of weed control, oat companions with contrasting canopies and time of sowing on subsequent forage yields, and determines the effect of interspecies competition during growth on root weights and carbohydrate levels of perennial forages. Five establishment methods on yields of 6 perennial forages in 2 similar experiments with controls showed incident solar radiation was significantly greater under oat companion with less-dense conopy with mild weed competition. Alfalfa stands were less sensitive to interspecies competition than crownvetch and birdsfoot trefoil. Treatments in low tiller densities showed a rapid recovery by the second harvest with adequate moisture and fertility, dry summer sowing of alfalfa and 3 grasses resulted in greater yields. Interspecies competition has a greater effect on the upper 15-cm root legume yield and upper 10-cm root-rhizome grass yield than on forage yields. Lowest carbohydrate levels occurred in weeded swards when fertility and moisture were limiting factors. Minerals and water supplies by root systems were important to carbohydrate accumulation. Little differences in carbohydrate levels among treatments resulted when moisture and fertility were inadequate. Figures and tables quantify these relations. (Popkin-Arizona)
W71-06215

EFFECT OF IRRIGATION ON RECOVERY OF APPLIED NITROGEN BY COTTON,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Auburn Univ., Ala. Dept. of Soils.
B. D. Doss, and C. E. Soarsbrook.
Agronomy Journal, 1969, Vol 61, No 1, p 37-40. 7 tab, 3 fig, 1 ref.

Descriptors: *Soil moisture, *Plant growth regulators, Root development, Fertilizers, Irrigation effects, Nitrogen, Cotton, Soil-water-plant relationships, Field capacity, Irrigation practices, Dry farming, Moisture uptake.
Identifiers: *Dry matter production, Irrigated crops.

Effects of soil moisture regime and nitrogen (N) rate on recovery of applied N by cotton were studied on a Greenville fine sandy loam. Irrigation increased total N uptake and decreased N percentage in plants. Applied N increased N percentage and total N uptake of plants, regardless of irrigation. Linear regression equations had slopes for N recovery on N applied for irrigated cotton twice as large as slopes for unirrigated cotton. Five years (1957 to 1959, 1965 to 1966) data for irrigated and unirrigated cotton fits the regression equation log Y equals 2.333 plus 0.727 log X, where Y is dry matter yield and X is N uptake. The cotton was grown at Thorsby (Alabama), where irrigation water was applied when 50% of available water was used in 60 cm of soil, and soil moisture and field capacity was measured gravimetrically. (Popkin-Arizona)
W71-06216

THE INFLUENCE OF VARIOUS SOIL MOISTURE-REGIMES ON THE YIELD AND QUALITY OF COTTON IN AN ARID ZONE,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
J. Amir, and H. Bielorai.
Journal of Agricultural Science, Camb., 1969, Vol 73, No 3, p 425-429. 4 tab, 1 fig, 14 ref.

Descriptors: *Soil moisture, *Crop production, *Cotton, *Irrigation practices, *Plant growth regulators, Drought tolerance, Water requirements, Moisture stress, Flowering, Arid lands.
Identifiers: *Lint quality, *Irrigation intervals, *Drought symptoms, Irrigated crops, Cotton lint, Cotton balls, Coastal Negev (Israel), Israel.

Irrigation is necessary to obtain high cotton yields in arid regions. Various soil moisture regimes on cotton in the coastal Negev (Israel) were investigated. Three irrigation experiments in the western Negev showed that maximum yields of 1700 to 2100 kg/ha cotton can be obtained with 3 irrigations by increasing irrigation at the beginning of flowering. About 0.31 kg of lint was produced per cubic meter of irrigation water. No differences in lint quality was detected between moisture-stress and wet-treatment cotton. Additional irrigation increased number of bolls/plant as long as there were clear drought symptoms, while average boll weight remained unaffected. Average boll weight was i creased, though there was no increase in number bolls/plant, by additional irrigation treatmen where there were no symptoms of water stre (Popkin-Arizona)
W71-06217

WATER USE BY COTTON FROM LOW AN MODERATELY SALINE STATIC WATER TA BLES,
Agricultural Research Service, Weslaco, Tex., an Texas Agricultural Experiment Station, Colleg Station.
For primary bibliographic entry see Field 03C.
W71-06221

SEED TABLETS FOR PRECISION PLANTIN LETTUCE,
Arizona Agricultural Experiment Station, Mesa.
B. L. Harriott.
Progressive Agriculture in Arizona, Vol 22, No Nov-Dec 1970, p 8-9. 1 tab, 4 fig, 1 ref.

Descriptors: *Seeds, *Planting, *Lettuce, *Wat conservation, *Application methods, Labor, Cro production, Feasibility, Treatment, Harvestin Mulching, Soil amendments, Irrigation efficienc Arizona, Coatings, Control.
Identifiers: Irrigated crop, Seedbed preparation Vermiculite, Tablets.

Lettuce is a major irrigated crop in Arizona. O timum planting of lettuce eliminates unnecessa labor, wasteful irrigation and conserves wate More than 60 variations of seedbed preparation seed treatments, seed coatings, soil amendmen and mulch applications were field evaluated sinc 1964. Seeds encased in compressed vermiculi disks prior to planting, and controlled spacin produced the largest emergence percentage (8 90%). Tableting can be done commercially for 1 parts vermiculite, 2 parts water, 1 part polyvin acetate by weight, and compression to 1/4 origin volume. Pushing the tablet into a properly prepare clod-free seedbed accomplishes planting. Prope seed selection, treatment and tableting makes feas ble planting to a final stand and once-over harves ing. Tableting may be feasible where stan establishment or plant uniformity is needed fo other crops. (Popkin-Arizona)
W71-06224

FERTILIZER MANAGEMENT FOR POLLU TION CONTROL,
Minnesota Univ., St. Paul. Dept. of Soil Science.
For primary bibliographic entry see Field 05G.
W71-06437

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

HYDRODYNAMIC EFFECTS OF SEEPAGE O BED PARTICLES,
Utah State Univ., Logan. Dept. of Civil Engineer ing.
For primary bibliographic entry see Field 02J.
W71-05839

DEVELOPMENT OF WATER RESOURCES I ASIA AND THE FAR EAST-REPORT OF TH NINTH SESSION OF THE BIENNIAL RE GIONAL CONFERENCE ON WATE RESOURCES DEVELOPMENT.
Economic Commission for Asia and the Far Eas (UN), New York.
For primary bibliographic entry see Field 06B.
W71-05864

TER RESOURCES DEVELOPMENT IN
)S.
nomic Commission for Asia and the Far East
N), New York.
primary bibliographic entry see Field 06B.
1-05865

)OD PLAIN INFORMATION, ELBA, ABAMA, PEA RIVER, WHITE WATER AND VER DAM CREEKS.
ps of Engineers, Mobile, Ala.

ps of Engineers Flood Plain Report, December
0. 33 p, 4 fig, 11 tab, 13 plate.

criptors: *Floods, *Flood damage, *Flood
ıs, *Alabama, Regional flood, Flood forecast-
Flood control.
tifiers: *Elba (Ala), Standard project flood, In-
iediate regional flood.

ding along the Pea River and Whitewater and
ver Dam Creeks at Elba, Coffee County,
ama is described to aid in solving local flood
lems and in planning the best utilization of
d-prone lands. Maps, profiles, cross sections
other material relating the extent of past flood-
o floods which might occur in the future are
d on available records of rainfall, runoff,
rical flood heights and other technical data.
most intense storm ever recorded in the vicini-
Elba occurred March 15, 1929. The official
rainfall for the 15th was 20 inches and total
he storm was a record 29.60 inches. Recovered
water mark at the highway bridge was 43.5
above the gage datum for an elevation of 202.7
above sea level. Only two persons lost their
during this flood, which rose to a height 13.5
above damage stage. (Woodard-USGS)
-05867

OD PLAIN INFORMATION, CALLEGUAS EK, VICINITY OF MOORPARK, VENTU-COUNTY, CALIFORNIA.
s of Engineers, Los Angeles, Calif.

s of Engineers Flood Plain Report, July 1970.
18 fig, 6 tab, 19 plate.

riptors: *Floods, *Flood damage, *Flood
s, *California, Historic flood, Flood forecast-
Regional flood, Design flood, Flood control.
tifiers: *Ventura County (Cal), Intermediate
nal flood, Standard project flood.

ding along Calleguas Creek in Ventura Coun-
alifornia from mile 30.00 in the City of Simi
y, to mile 12.67 near Somis is described to aid
lving local flood problems and in planning the
utilization of flood-prone lands. Maps,
les, cross sections, and text material relating
xtent of past flooding to floods which might
r in the future are based on available records
nfall, runoff, historical flood heights and other
rical data. The highest peak discharge ever
rded in the study reach, 6,330 cubic feet per
nd, was measured at the Strathearn bridge
m-gaging station from a drainage area of 78
re miles on February 25, 1969. There was ex-
ve damage to agricultural property, to the
rpark Water Pollution Control Plant, and to
rical and telephone utilities. A total of about
,000 damage (1969 price levels) was
ined. The estimated discharge peak for the In-
diate Regional flood at the Strathearn bridge
is 19,000 cfs, and for the Standard Project
, 31,000 cfs. (Woodard-USGS)
-05868

EAMFLOW SYNTHESIS,
ard Univ., Cambridge, Mass.
n B. Fiering.
bridge, Harvard University Press, 1967. 139 p

riptors: *Streamflow, Hydrology, *Simulation
sis, Economic evaluation, Regression analysis,
e Carlo method, Systems analysis, Risk,
unt rate.

Identifiers: *Reservoir design, *Storage-yield function, Decision theory, Objective function, Lagrangian method.

This book considers models of the water storage-yield relationship in order to determine the flow patterns associated with reservoir design. Early empirical solutions to the reservoir design or storage-yield problem are discussed in detail. As an approach to optimal reservoir design, the author uses operational hydrology to estimate system performance and benefit functions. An algorithm for optimal operation of a reservoir with deterministic flow is developed. Decision theory is then applied to operational hydrology to generate storage-yield functions. Case studies are cited to illustrate the efficiency of the operational hydrology and simulation in the design of water resource systems. The reservoir-storage-yield function establishes operational hydrology as an important tool in simulation as well as design. (Siegenthaler-Rutgers)
W71-05946

ALGAECIDAL EVALUATION AND ENVIRONMENTAL STUDY OF MAT PRODUCING BLUEGREEN ALGAE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Naman E. Otto.
Available from NTIS as PB-194 808, $3.00 in paper copy, $0.95 in microfiche. Bur of Reclam Report REC-OCE-70-25, June 1970. 27 p, 13 fig, 7 tab, 27 ref.

Descriptors: *Algae, *Aquatic weeds, *Weed control, Growth, *Cultures, *Algicides, Bibliographies, *Ecology, Aquatic life, Irrigation systems, Water analysis, Temperature, Limnology, Cyanophyta, Irrigation canals, Algal control.
Identifiers: *Algae culture technique, Aquatic weed study facility, Product evaluation, Blue-green algae.

Algaecidal tests of 74 compounds showed that only 9 were more active than copper sulfate, and one provided total control of the blue-green algae mat colonies. Results of preliminary algaecidal field tests with copper sulfate and admixtures of enhance activity are given. Observations of algaecidal treatments on an irrigation canal suggest that copper sulfate applications of 0.48 lb/cfs applied every 2 wk suppressed blue-green mat growth. Water temperature appears critical to treatment success. Results of studies conducted in 1967-1969 to determine environmental parameters of irrigation canals are presented. Data show that mat-type, blue-green algae grow in a wide range of water quality and temperature conditions and do not require enriched conditions for growth. Coloration substances in the water may influence the availability of micronutrient metals and may stimulate directly blue-green algae growth.
W71-06102

CANAL CAPACITY STUDIES MAIN CANAL COLUMBIA BASIN PROJECT,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Mansil W. Scrivner.
Available from NTIS as PB-196 741, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Report REC-OCE-70-31, July 1970. 128 p, 7 fig, 6 tab.

Descriptors: Canals, *Roughness coefficient, Open channel flow, *Flow resistance, *Analysis, Rigid linings, Trapezoidal channels, *Mannings equation, *Head loss, *Algae, Reaches (Distance), Horizontal curves, Research and development, Field data, Subcritical flow, Hydraulics, Chemicals, Washington, Fluctuation, Water surface, Field tests, *Hydraulic properties, Aquatic weeds.
Identifiers: Concrete linings, Main Canal, CBP, Wash, Columbia Basin Proj, Wash.

Additional tests were made during 1965, 1966, and 1967 on the Long Lake Reach of the Main Canal, Columbia Basin Project, to determine the hydraulic properties of the canal and the effect of aquatic growths during these years. Test methods and observation locations were the same as the 1963-64 studies. Filamentous algae growth was light to moderate and generally much below that observed during prior seasons. Fresh water sponge infestation was reported to be increasing. Flow resistance improvement after treatment of the canal with copper sulfate was not as great as had been anticipated. Two weeks after treatment, flow resistance returned to about pretreatment values.
W71-06109

FLOOD PLAIN INFORMATION, KINGFISHER AND UNCLE JOHN'S CREEKS, KINGFISHER, OKLAHOMA.
Corps of Engineers, Tulsa, Okla.

Corps of Engineers Flood Plain Report, January 1971. 35 p, 7 fig, 16 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Oklahoma, Regional flood, Flood forecasting, Flood control, Peak discharge, Rainfall-runoff relationships, Historic flood.
Identifiers: *Kingfisher (Okla), Standard project flood, Intermediate regional flood.

Flooding along Kingfisher and Uncle John's Creeks in the vicinity of Kingfisher, Oklahoma is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known to have occurred during recent history on Kingfisher and Uncle John's Creeks, occurred in June 1948. Although this flood did not produce the highest water elevations in some parts of Kingfisher, the discharge was greater than any other known flood on both creeks. Another great flood, in September 1961, was the second largest flood. The discharge was slightly less than the June 1948 flood. (Woodard-USGS)
W71-06119

FRONTIERS IN CONSERVATION.
For primary bibliographic entry see Field 04C.
W71-06129

THE SOCIAL AND ECONOMIC NEED FOR FLOODPLAIN REGULATION,
Soil Conservation Service, Denver, Colo.
Ronald I. Blewitt.
In: Frontiers in Conservation, Proceedings 24th Annual Meeting Soil Conservation Society of America, August 10-13, 1969, Colorado State University, Fort Collins, p 145-149, 1970. 5 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Flood plains, *Flood damage, *Flood control, *Floods, *Flood plain zoning, Flood protection, Building codes, Abatement, Check structures, Drainage systems, Multiple-purpose projects, Water management (Applied), Colorado.

Floods cause over a billion dollars damage a year in the United States, and the damage is increasing in spite of an annual federal investment of over $500 million. Widespread storms over eastern Colorado in June 1965 caused more than $500 million damage; 21 people lost their lives. Unfortunately, the people living in the floodplain were probably unaware of the hazard under which they lived. No doubt they are now convinced that floodplain settlement should be regulated by zoning or that flood control structures should be built before people settle in floodplains. But then it would be difficult to justify them, and so a cycle of settlement, flood damage, and building costly control structures continues. One can see the tremendous need for multicounty organizations to properly plan and zone land not yet developed and to provide rights-of-way for control structures before their cost becomes ex-

cessive. Floodplains can be put to many uses other than residential, business, and industrial development. These include (1) greenbelts, (2) development of natural resources, (3) recreation, (4) highways, and (5) permissible occupation. (See also W71-06129) (Woodard-USGS)
W71-06131

SNOW AND RESERVOIR MANAGEMENT IN CANADA FOR THE COLUMBIA RIVER TREATY OPERATION,
British Columbia Hydro and Power Authority, Vancouver, Canada, Hydrology Branch.
For primary bibliographic entry see Field 02C.
W71-06134

THE DEVELOPMENT AND APPLICATION OF A HYDROLOGIC MODEL AS AN OPERATIONAL TOOL,
Sierra Hydrotechnology, Placerville, Calif., and California Cooperative Snow Surveys, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 02C.
W71-06135

USING ALL AVAILABLE HYDROLOGIC DATA,
British Columbia Water Resources Service, Vancouver; and British Columbia Univ., Vancouver. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-06138

THE DESCHUTES RIVER HYDROGRAPH FORECAST,
Soil Conservation Service, Portland, Oreg.
Tommy A. George.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 68-73, 1970. 6 p, 9 plate, 1 tab, 4 ref.

Descriptors: *Streamflow forecasting, *Hydrograph analysis, *Oregon, Water management (Applied), Snowmelt, Water rights, Regression analysis, Irrigation water.
Identifiers: *Deschutes River (Oreg).

This paper explains the procedure used to forecast critical flow levels and the dates that these levels will occur on the Deschutes River at Bend, Oregon. The value of the forecast to water users in relation to their water rights, and the problems involved in reconstructing the streamflow hydrograph used in deriving the forecast equations are discussed. Examples of forecasted versus actual hydrographs for the past several years are included. The information is used by the watermaster and irrigation districts in managing the river and their water use. (See also W71-06133) (Knapp-USGS)
W71-06144

PHYSICAL PROPERTIES AND PROCESSING CHARACTERISTICS OF MACROPHYTES AS RELATED TO MECHANICAL HARVESTING,
Wisconsin Univ., Madison. Water Resources Center.
H. D. Bruhn, D. F. Livermore, and F. O. Aboaba.
Available from NTIS as PB-198 129, $3.00 in paper copy, $0.95 in microfiche. Reprint, American Society of Agricultural Engineers, St Joseph, Michigan 49085, Paper 70-582, 1970. 17 p, 12 fig, 30 ref. OWRR Project B-018-WIS (2).

Descriptors: *Harvesting of algae, *Aquatic weed control, *Mechanical control, *Dewatering.
Identifiers: Farm machinery, Industrial machinery, Utilization, Modification.

Selective mechanical harvesting of undesirable aquatic vegetation appears to be a feasible and ecologically sound approach to control in recreational waters. The transportation from the harvest area to the disposal site is a major expense in the overall harvest operation. Since aquatic vegetation is approximately 90 per cent water processing and dewatering this material as a part of the initial harvesting operation greatly facilitates its transportation and ultimate disposal or utilization. Intensive mechanical dewatering based on procedures developed in this research results in reducing the fibrous fraction of aquatic vegetation to 16 per cent of its original volume and 32 per cent of its original weight, while removing from the harvested area 90 per cent of the original dry matter, 85 per cent of the protein, 60 per cent of the potassium, and 80 per cent of the phosphorus present in the growing vegetation. The reduction in fiber length resulting from the dewatering process increases the ease with which the vegetative material can be transferred through conveying systems thus further facilitating handling and disposal. The major portion of the equipment required for the preprocessing and dewatering can be developed by utilization and modification of components of all readily available farm and industrial machinery.
W71-06188

WATER RELATED LAND USE IN THE BEAR RIVER DRAINAGE AREA,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 07C.
W71-06212

WATER RELATED LAND USE IN THE UTAH LAKE DRAINAGE AREA,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 07C.
W71-06213

HYDROLOGIC INVENTORY OF THE UTAH LAKE DRAINAGE AREA,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-06218

HYDROLOGIC INVENTORY OF THE UINTAH STUDY UNIT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-06219

HYDROLOGIC INVENTORY OF THE WEBER RIVER STUDY UNIT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-06220

THE SAN SIMON WATERSHED: REVEGETATION,
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 04D.
W71-06223

PINYON-JUNIPER CONTROL: WHERE. WHY,
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Univ., Tucson. Dept. of Range Management.
For primary bibliographic entry see Field 04D.
W71-06225

FLOOD PLAIN INFORMATION, ONTONAGON RIVER, ONTONAGON, MICHIGAN, AND LAKE SUPERIOR SHORELINE, ONTONAGON COUNTY, MICHIGAN.
Stanley Consultants, Inc., Muscatine, Iowa.

Corps of Engineers Flood Plain Report, September 1970. 120 p, 67 fig, 26 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Michigan, *Beach erosion, *Lake Superior, Flood plains, Regional flood, Flood forecasting, Flood contr
Sediment transport, Historic flood
Identifiers: *Ontonagon C
project flood, Intermed

The flood situation
the vicinity of Onto
erosions along Lake
County shoreline are de
local flood problems and m
utilization of flood-prone lands. Maps, profil
cross sections, and text material relating the ext
of past flooding to floods which might occur in
future are based on available records of rainfall,
noff, historical flood heights and other techni
data. Analysis indicates that the extent of erosi
by the year 2020 for the Ontonagon Cou
shoreline along Lake Superior may be as much
150 feet of shoreline. (Woodard-USGS)
W71-06232

A CRAZY IDEA ON URBAN WATER MANAGEMENT,
Pennsylvania State Univ., Unversity Park. Dept.
Civil Engineering.
For primary bibliographic entry see Field 06B.
W71-06309

DRAINAGE OF WIDE ROAD PAVEMENTS,
For primary bibliographic entry see Field 08A.
W71-06368

**STUDIES ON THE CHEMICAL CONTROL
TREE ROOTS IN SEWER LINES,**
O. A. Leonard, and Neal Townley.
Paper presented at the Calif WPCA 42nd Ann
Conference, Sacramento, Calif, April 29 to May
1970.

Descriptors: *Sewers, *Laboratory tests, *Ro
systems.
Identifiers: *Tree roots, Sewer hydraulics.

This study was a cooperative effort by the auth
and Dr. Ahrens of the Connecticut Agricultural E
periment Station. The problem was studied
Davis and the Utilities Division of Sacramento
growing wood plants in pots filled with a potti
mix which were placed on open cans. Roots whi
grew into cans were treated for periods of time
solutions of different chemicals. The most prom
ing treatments were examined in a single test
July 1969 in the sewer lines of Sacramento Coun
All treatments were effective in killing the roots
the lines but some were more effective than oth
in killing roots in and outside of joints. Studies a
being continued to evaluate factors influencing k
cost, and safety to trees.
W71-06397

**HERBICIDE RESIDUES IN AGRICULTURA
WATER FROM CONTROL OF AQUATIC AN
BANK WEEDS,**
Agricultural Research Service, Denver, Colo. Cr
Research Div; and Agricultural Research Servic
Laramie, Wyo. Crops Research Div.
For primary bibliographic entry see Field 05B.
W71-06440

4B. Groundwater Management

**WATER RESOURCES OF NASSAU AND SU
FOLK COUNTIES,**
Holzmacher, McLendon and Murrell, Melvill
N.Y.
For primary bibliographic entry see Field 03D.
W71-05843

**WATER RESOURCES OF THE HEBE
KAMAS-PARK CITY AREA, NORTH-CENTRA
UTAH,**
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02E.

71-05852

OUNDWATER RESOURCES OF THE YSVILLE AND MIFFLINTOWN QUADRANES IN SOUTH-CENTRAL PENNSYLVANIA,
ological Survey, Harrisburg, Pa. Water ources Div.
rbert E. Johnston.
ies may be purchased from Bureau of Publicas, Tenth and Market Streets, Harrisburg, Penn. 25. Pennsylvania Geological Survey Fourth Se- Bulletin W-27, 1970. 96 p, 12 fig, 2 plate, 14 23 ref.

criptors: *Water resources, *Groundwater, nnsylvania, *Hydrologic data, *Data collecs, Water wells, Hydrogeology, Geology, ifers, Aquifer characteristics, Water yield, cific capacity, Water quality, Chemical analy- Topography, Water utilization, Consumptive Meteorology, Evaluation, Water resources elopment, Hydrology, Maps.
tifiers: *South-central Pennsylvania, *Groundr resources, Test holes, Well logs.

Loysville and Mifflintown quadrangles include rea of about 460 square miles of valley and e terrain in south-central Pennsylvania. This is underlain by strongly folded sedimentary s that consist chiefly of sandstone, siltstone, e, and limestone of Ordovician, Silurian, and onian age. Yields reported for more than 500 s ranged from less than 1 gpm to 275 gpm; the ian yield was 12 gpm. Fewer than 5% of the s were reported to yield more than 50 gpm, and r than 3% were reported to yield less than 1 . Evaluation of reported-yield data, specificcity data, and borehole-flow data from the est wells inventoried indicate that the prin- yielding zones generally occur above a depth out 200 feet. Water from calcareous shales imestones generally has a dissolved-solids con- of 200 to 300 mg/liter and the water is rally hard to very hard. Water from the nonreous shales, siltstone, and sandstones rally has a total dissolved-solids content of 100 0 mg/liter, and is generally soft to moderately (Woodard-USGS)
-05853

CHEMICAL SURVEY OF MISSOURI, NS AND PROGRESS FOR SECOND SIXTH PERIOD (JANUARY-JUNE, 1970).
ogical Survey, Denver, Colo. Regional hemistry Branch.
rimary bibliographic entry see Field 02K.
-05854

ER-RESOURCES APPRAISAL OF THE UMBUS SALT MARSH-SODA SPRING LEY AREA, MINERAL AND ESMERALDA NTIES, NEVADA,
gical Survey, Carson City, Nev.
Van Denburgh, and Patrick A. Glancy.
da Division of Water Resources, Water rces-Reconnaissance Series Report 52, 1970. 2 fig, 17 tab, 26 ref, 9 photo.

iptors: *Water resources, *Great Basin, ada, *Hydrologic data, Data collections, ndwater, Surface waters, Evaluation, Aquifer cteristics, Water yield, Water quality, Chemianalysis, Withdrawal, Water wells, Runoff, otranspiration, Storage, Groundwater rge, Geology, Consumptive use.

,940-square-mile area covered by this study es in the southwestern part of the Great Basin ada and encompasses 13 valleys. Altitudes in ea range from 4,370 feet on the floor of s Salt Marsh Valley to 13,140 feet at the f Boundary Peak. Precipitation averages 3-6 at the lower altitudes and 20 inches or more highest mountain areas. The growing season on a minimum temperature of 28 deg F) e 170-200 days on the lower valley floors, ss than 100-150 days at higher altitudes. The quantitative hydrologic character of each valley is summarized. Wells yield groundwater solely from the alluvium at depths that generally range from 30 to 300 feet. Groundwater withdrawals are minor (less than 5-10 acre-feet per year) in all but eastern Soda Spring Valley, where they are about 30 acre-feet per year. The chemical character of water in the report area is highly variable, even within a single valley. Groundwater in Columbus and Rhodes Salt Marsh Valleys is the least suitable for domestic and agricultural use, wheras most water in the other valleys is generally acceptable. In some places, excessive fluoride is or may be a problem for domestic use. (Woodard-USGS)
W71-05862

RECONNAISSANCE INVESTIGATION OF THE SUBSIDENCE OF VENICE AND SUGGESTED STEPS TOWARD ITS CONTROL,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-05870

COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 02F.
W71-05920

RURAL WATER DISTRICTS--HERE IS WHY THEY ARE NEEDED,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 06B.
W71-06061

SEVENTH BIENNIAL CONFERENCE ON GROUNDWATER (PROGRESS, PRACTICE, AND POTENTIAL OF GROUNDWATER RECHARGE, DEVELOPMENT AND MANAGEMENT).

Copies available from Univ. of California, Water Resources Center, Los Angeles, Calif. 90024 - Price $3.00 each. Proceedings 7th Biennial Conference on Groundwater, held at University of California, Los Angeles, September 10-11, 1969: Los Angeles, California University Water Resources Center Report No 18, 1970. 235 p, append.

Descriptors: *Groundwater, *Water supply, *Conferences, *California, Water yield, Water resources development, Water demand, Water utilization, Aquifers, Water wells, Pumping, Water costs, Conjunctive use.
Identifiers: *University of California at Los Angeles.

These conference proceedings included presentations and panel discussions of technical papers pertaining to groundwater hydrology. Topics include progress on the Institutional front; progress on the technical front; new approaches and techniques; framework of the future; and needs of the future. Papers related to new approaches and techniques emphasize streamflow augmentation by groundwater utilization. This has already been operated in the Thames River Basin in England and the Great Miami River Basin in Ohio (U.S.A.). Pertinent information of water balance, water demand, water yield, and water costs is included. (See also W71-06118) (Woodard-USGS)
W71-06117

POTENTIAL FOR STREAMFLOW AUGMENTATION BY GROUNDWATER PUMPING,
Miami Conservancy District, Dayton, Ohio.
Richard F. Thomas.
In: Proceedings 7th Biennial Conference on Groundwater, held at University of California, Los Angeles, September 10-11, 1969: Los Angeles, California University Water Resources Center Report No 18, p 73-92, 1970. 20 p, 3 fig, 2 tab, 5 ref.

Descriptors: *Conjunctive use, *Water resources development, Ohio, *Low-flow augmentation, *Groundwater, Water yield, Water demand, Water utilization, Water costs, Aquifers, Pumping, Water wells, Water supply, Streamflow.
Identifiers: *Streamflow augmentation, *Great Miami River Basin (Ohio).

The characteristics of the potential groundwater augmentation scheme for the Great Miami River in Ohio include: (a) An average annual demand of about 30,000 acre-feet; (b) a one in 10-year demand of 64,500 acre-feet; (c) one in 10-year pumping rate of 280 cfs with a nearly linear distribution from 1 to the maximum rate for the critical period of 280 days; (d) Well field containing 92 wells; and (e) Wells 18 inches in diameter, 150 feet deep, and 500-foot apart. Preliminary estimates of cost of the groundwater pumping scheme are $3.5 to $5 million. A comparable surface reservoir would cost a minimum of $30 million. In the Great Miami River Basin glacial outwash deposits form the best aquifers. Outwash deposits fill the buried valleys to a thickness of 100 to 250 feet in the main valleys and to generally less than 100 feet in the tributary valleys. Individual wells near a stream can yield up to 3,000 gallons per minute, while wells not receiving induced recharge yield 500 to 1,000 gpm. Total water storage in the buried valley system along the Great Miami, the Stillwater and Mad Rivers is approximately 6,500,000 acre-feet. (See also W71-06117) (WOoodard-USGS)
W71-06118

VENICE IS SINKING INTO THE SEA,
Electroconsult, Milan (Italy).
For primary bibliographic entry see Field 02F.
W71-06120

AVAILABILITY OF GROUNDWATER IN CHARLES COUNTY, MARYLAND,
Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 02F.
W71-06168

AVAILABILITY OF GROUNDWATER IN DECATUR COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02F.
W71-06175

SEEPAGE FACE EFFECTS IN UNSTEADY GROUNDWATER FLOW,
Wisconsin Univ., Madison. Water Resources Center; and Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-06190

WATER USE BY COTTON FROM LOW AND MODERATELY SALINE STATIC WATER TABLES,
Agricultural Research Service, Weslaco, Tex., and Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 03C.
W71-06221

WELL RECORDS, DEPTH-TO-WATER MEASUREMENTS, CHEMICAL ANALYSES OF GROUND WATER, DRILLERS LOGS, AND ELECTRIC-LOG INFORMATION IN HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS,
Geological Survey, Little Rock, Ark.
J. W. Stephens.
Geological Survey Report, 1970. 197 p, 6 fig, 25 tab.

Descriptors: *Groundwater, *Water resources development, *Hydrologic data, *Data collections, *Arkansas, Water wells, Drill holes, Aquifers, Aquifer characteristics, Water yield, Water levels,

Water quality, Chemical analysis, Logging (Recording), Water utilization, Consumptive use.
Identifiers: *Southwest Arkansas, Well logs, Well data, Well depth.

This report is a compilation of hydrogeologic data collected during a water-resources investigation of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas. The data have been prepared for use in planning water-resources development in the area. Most of data were collected between January 1967 and October 1968, and includes records of 479 wells and test holes; results of chemical analyses of water samples from 197 wells; electric-log information from 131 locations; lithologic logs of 126 wells and test holes; and measurement of water levels in 149 wells. (Woodard-USGS)
W71-06229

ARTIFICIAL RECHARGE PRACTICES IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
David R. Hargis, and Frank L. Peterson.
Available from NTIS as PB-198 233, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 43, October 1970. 36 p, 4 tab, 9 fig, 22 ref. OWRR Project A-028-HI (1).

Descriptors: *Hawaii, *Artificial recharge, Groundwater, Water spreading, Wells, Shafts (Excavations), Irrigation, Cesspool, Seepage, Ditch, Pit recharge.
Identifiers: Ditch leakage.

Artificial recharge practices in Hawaii include stream-water recharge through wells and shafts, storm drainage disposal through wells and pits, induced leakage from ditches and reservoirs and deliberate spreading of excess irrigation water, incidental ditch and reservoir leakage and other nondeliberate recharge of irrigation water, and cesspool seepage. The most significant source of artificial recharge to groundwater bodies in Hawaii is probably recharge incidental to irrigation. Deliberate artificial recharge to groundwater bodies consists of wells recharging stream water at Hanapepe, Kanuai and Puukapu, Hawaii, wells and pits which dispose of storm drainage at Wailuku and Kahului, Maui and Hilo, Hawaii, and excess irrigation water by induced leakage from ditches and reservoirs and water spreading over fields and in gulches at Hawaiian Commercial and Sugar Company on the East Maui isthmus. In addition, the Department of Land and Natural Resources of the State of Hawaii will begin disposal of treated sewage through three deep wells at Waimanalo, Oahu as soon as sewerage is completed.
W71-06263

AN ECONOMIC ANALYSIS OF THE INTERTEMPORAL ALLOCATION OF GROUNDWATER IN THE CENTRAL OGALLALA FORMATION,
Oklahoma State Univ., Dept. of Agricultural Economics.
Solomon Bekure.
Ph.D. Dissertation, May 1971. 227 p, 5 fig, 56 tab, 28 ref, 7 append. OWRR Project A-010-OKLA (1)

Descriptors: *Allocation, *Models, Crop production, Water table, Groundwater, Withdrawal, Linear programming, *Economic impact, *Natural resources, *Water utilization, Resource allocation, *Water supply
Identifiers: *Intertemporal allocation, Well yield, Ogallala formation

This dissertation is concerned with the investigation of the intertemporal allocation of groundwater in the Central Ogallala Formation. The major objective of this study is to present estimates of (1) the growth of irrigation in the study area and (2) the rate of depletion of the aquifer over time and its effects on (a) the pattern of irrigated crop production and (b) the gross and net receipts to irrigated crop production over time. Two recursive linear programming models were employed to depict the pattern of irrigated crop production over the period 1965-2070. A multi-stage sequential decision model was developed and the dynamic programming technique was used in order to determine the optimal allocation of groundwater over a planning horizon of 100 years. Assumptions, models and input data were presented. Results of each model and comparisons of the results were discussed. It indicated that irrigators in the study area will not misallocate the groundwater resource for discount rates other than zero by Model I. But Model II showed that the population of the area should be concerned about uneconomic mining of groundwater after 1990. (Wang-Rutgers)
W71-06266

4C. Effects on Water of Man's Non-Water Activities

RECONNAISSANCE INVESTIGATION OF THE SUBSIDENCE OF VENICE AND SUGGESTED STEPS TOWARD ITS CONTROL,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-05870

JAMAICA BAY AND KENNEDY AIRPORT: A MULTIDISCIPLINARY ENVIRONMENTAL STUDY.
Jamaica Bay Environmental Study Group, N.Y.
For primary bibliographic entry see Field 06G.
W71-06045

WATERFRONT LAND USE IN THE AUSTRALIAN STATE CAPITALS,
Victoria Univ., (British Columbia). Dept. of Geography.
For primary bibliographic entry see Field 06B.
W71-06065

FRONTIERS IN CONSERVATION.

Available from Soil Conservation Society of America, 7515 Northeast Ankeny Rd., Ankeny, Iowa 50021-Price $5.00. Proceedings 24th Annual Meeting Soil Conservation Society of America, August 10-13, 1969, Colorado State University, Fort Collins, 1970. 162 p.

Descriptors: *Conferences, *Conservation, *Land management, *Watershed management, Methodology, Planning, Water resources, Floods, Wastes, Pollution, Agriculture, Forestry, Recreation facilities, Urbanization, Flood control, Soils, Crops, Vegetation, Water pollution sources, Economics, Abatement, Social aspects, Sediment transport.

Forty-four papers presented at the 24th annual meeting of the Soil Conservation Society of America are included in this volume. Major topics include: Soil and Land Management to Meet Conservation Goals; Water Resources Utilization and Management; Wastes in Relation to Agriculture and Forestry; Outdoor Recreational and Natural Beauty Needs and Opportunities; Urban-Suburban Conservation; and Utilization of Land to Meet Future Needs. Portions of the meeting included college-student sessions and technical-study committee sessions. (See also W71-06130 thru W71-06132) (Woodard-USGS)
W71-06129

WATER QUALITY AT THE DADE-COLLIER TRAINING AND TRANSITION AIRPORT, MIAMI INTERNATIONAL AIRPORT, AND COTTONMOUTH CAMP-EVERGLADES NATIONAL PARK, FLORIDA, NOVEMBER, 1969,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05A.
W71-06158

SELECTED URBAN STORM WATER RUNO ABSTRACTS.
Franklin Inst. Research Labs., Philadelphia, Pa.

Copy available from GPO Sup Doc as I67, 13 11024 EJC 07/70, $2.75; microfiche from NTIS PB-198 228, $0.95. EPA-WQO Report No 110 EJC, Jul 1970. 375 p. FWQA Contract No 14-704. FWQA Program 11024EJC.

Descriptors: *Storm runoff, *Urbanizati Drainage systems, Overflow, Rainfall-runoff re tionships, Sewers, Sewage treatment, Water pol tion control.
Identifiers: *Combined sewers, *Storm sewers.

A compilation of abstracts summarizing artic from a variety of technical publications constit ing the problem of urban drainage was develop by the Franklin Institute Research Laboratori The present work includes 599 abstracts of do ments published for the most part from July 19 through June 1970. The abstracts are classed in sub-topic categories and arranged alphabetically author and numerically by abstract number wit each category. Each item includes a bibliograp citation, an abstract, and a set of indexing descr tors and identifiers. A cumulative subject index the end of the volume provides the necessary cess to individual concepts. An author index a journal list are also included. (See also W 10085, W71-06254 and W71-06255) (Ortn Franklin Institute)
W71-06253

SELECTED URBAN STORM WATER RUNO ABSTRACTS (FIRST QUARTERLY ISSUE).
Franklin Inst. Research Labs., Philadelphia, Pa.

Copy available from GPO Sup Doc as I67.13 11024 EJC 10/70, $0.50; microfiche from NTIS PB-198 229, $0.95. EPA-WQO Report No. 110 EJC Oct 1970. 37 p. EPA-WQO Contract 14-1 904.

Descriptors: *Storm runoff, *Drainage, *Sewe Water pollution control, *Overflow, Polluti abatement, Sewerage, Urbanization, Treatm facilities.
Identifiers: *Combined sewers, *Storm sewers.

The first quarterly supplement to SELECT URBAN STORM WATER RUNOFF A STRACTS is a compilation of abstracts summar ing articles from a variety of technical literatu concerning the problem of urban drain published from July 1970 through Septem 1970. The 36 abstracts covering a range of ci sections are arranged alphabetically by author a numerically by abstract number within e category. Each item includes a bibliographic ci tion, an abstract, and a set of indexing descript and identifiers. A cumulative subject index at t end of the volume provides the necessary access individual concepts. An author index and jour list are also included. This work was submitted fulfillment of Contract 14-12-904 between t Federal Water Quality Administration and t Franklin Institute Research Laboratories. (See a W69-10085, W71-06253 and W71-0625 (Ortner-Franklin Institute)
W71-06254

SELECTED URBAN STORM WATER RUNO ABSTRACTS (SECOND QUARTERLY ISSUE).
Franklin Institute Research Labs., Philadelphia, P

Copy available from GPO Sup Doc as EP2.1 11024 EJC 01/71, EPA/WQO Contract No 14-1 904, $0.60; microfiche from NTIS as PB-198 3 $0.95. EPA-WQO Report No 11024 EJC, 0 1970. 45 p.

scriptors: *Overflow, Pollution abatement, ewerage, *Sewers, *Storm runoff, *Urbaniza-n, *Water pollution sources, Treatment facili-s, Water pollution control.
ntifiers: *Combined sewers, *Storm sewers.

e second quarterly supplement to SELECTED BAN STORM WATER RUNOFF AB-RACTS is a compilation of abstracts summariz- articles from a variety of technical literature ncerning the problem of urban drainage olished from October 1970 through December 70. The 50 abstracts covering a range of ten sec-ns are arranged alphabetically by author and nu-rically by abstract number within each category. ch item includes a bibliographic citation, an ab-ct, and a set of indexing descriptors and ntifiers. A cumulative subject index at the end of volume provides the necessary access to in-dual concepts. An author index and a journal are also included. (See also W69-10085, W71-53 and W71-06254) (Ortner-Franklin In-ute)
1-06255

ULATION OF RUNOFF FROM URBAN TERSHEDS,
h Water Research Lab., Logan.
. Dhruva Narayana, J. Paul Riley, and Eugene sraelsen.
ter Resources Bulletin, Vol 7, No 1, p 54-68, ruary 1971. 6 fig, 5 tab, 5 ref.

criptors: *Urbanization, *Runoff, *Simulation lysis, *Analytic techniques, Mathematical lels, Hydrograph analysis.
tifiers: *Urban watersheds, *Urban hydrology, tiple regression analysis, Urban hydrologic lels.

nathematical model for urban watersheds is g developed in stages at the Utah Water earch Laboratory, Utah State University at an. In verifying the watershed as a unit, ershed coefficients are determined on the com-r, and related to the urbanization charac-tics. The second stage of verification consists viding the watershed into subzones, and deter-ng the urban parameters within each subzone. n subzone is then individually modeled, and low hydrographs are routed through succeed-downstream subzones to the gaging point. The el thus makes it possible to: (a) develop runoff els for subzone hydrographs within the urban rshed, and (b) account for spatial variations of n and watershed characteristics. An attempt also made to analytically model the outflow ograph based on storm and watershed charac-tics. (Davis-Chicago)
-06306

Watershed Protection

NTING CORN IN NATIVE SOD,
raska Univ., Lincoln. Agricultural Experiment on.
primary bibliographic entry see Field 03F.
-06060

SAN SIMON WATERSHED: REVEGETA-N,
ona Univ., Tucson. Dept. of Watershed agement; and Arizona Agricultural Experi-Station, Tucson.
ert L. Jordan, and Michael L. Maynard.
ressive Agriculture in Arizona, Vol 22, No 6, Dec 1970, p 4-7. 1 tab, 3 fig, 2 ref.

riptors: *Revegetation, *Brush control, ge grasses, *Soil-plant-water relationships, er-shed management, Arizona, Reclamation, erosion, Creosote, Mesquite, Soil moisture, lands, Rainfall, Cultivation, Crop production, texture, Distribution, Land management, s, Research and development, Mechanical ol.

Identifiers: *San Simon watershed (Arizona), *Lehmann lovegrass, Semi-arid lands, Chaining, Pitting.

Reclamation of the eroded and frail San Simon watershed (Southeastern Arizona) is based on revegetation. Mechanical shrub control of creosotebush and sand-dune mesquite increases available soil moisture to native range grasses. Grass-reseeding and shrub-control studies were conducted to evaluate an optimum response balance under hot semi-arid conditions. There was no emergence of Lehmann lovegrass until summer rainstorms, regardless of planting time or spring rains. Lovegrass is required tillage to yield, though chaining and pitting showed promise. Soil moisture and texture are discussed for grass yields. Precipitation distribution in time and amount is the key to effective land management. Of the 9.5 inches of annual rainfall, 58% (5.5 inches) occur randomly during the summer growing season. Plowed seedbeds of Lehmann lovegrass produce the most dependable yield. Research is continuing on effective plowing methods, seedbed manipulation through different pits, fungicide treatment of seeds, seed germination, selection and development of adopted grasses, and other factors useful in managing semiarid wildland. (Popkin-Arizona)
W71-06223

PINYON-JUNIPER CONTROL: WHERE. WHY,
Arizona Univ., Tucson. Dept. of Watershed Management; and Arizona Univ., Tucson. Dept. of Range Management.
J. T. O'Rourke, and P. R. Ogden.
Progressive Agriculture in Arizona, Vol 22, No 6, Nov-Dec 1970, p 12-15. 1 tab, 3 fig.

Descriptors: *Juniper trees, *Pinyon pine trees, *Revegetation, *Erosion control, *Brush control, Watershed management, Soil textures, Phosphates, Neutralization, Calcium carbonate, Crop production, Marketing, Forages, Soil, Precipitation, Vegetation, Grazing, New Mexico, Arizona, Nevada, California.
Identifiers: *Wood products.

A discontinuous belt of pinyon-juniper (P-J) is found through New Mexico, Arizona, Nevada and California. Grazing in this belt is delicately balanced with P-J so that P-J control must be successfully conducted to minimize erosion. The object of this study is to measure precipitation, soil and vegetation characteristics to determine the influence of each on production and density of forages planted after P-J control. Four study sites in northern Arizona were selected. P-J control is recommended where there is a market for wood-products removed, in areas of high P-J density, high precipitation, low calcium carbonate, near neutral pH, high available phosphates, and medium-textured soils. Care in extrapolation of data to other areas is recommended. Soil-water-plant relationships are basic to P-J control. (Popkin-Arizona)
W71-06225

TREATMENT OF ACID MINE DRAINAGE BY OZONE OXIDATION,
Brookhaven National Lab., Upton, N.Y.
M. Beller, C. Waide, and M. Steinberg.
Copy available from GPO Sup Doc as WQO Report 14010FMH, Dec, 1970, $1.00; microfiche from NTIS as PB-198 225, $0.95. Environmental Protection Agency-W20 Report 14010FMH, Dec 1970. 91 p, 23 fig, 28 tab, 40 ref. EPA-WQO Contract No 14-12-838.

Descriptors: *Mine Drainage, *Iron oxides, *Ozone, Industrial wastes, Neutralization, Limestones, Iron, Costs, Treatment, Waste water treatment, Oxidation.
Identifiers: Ferrous iron, Ferric iron.

An engineering design and economic study to evaluate the feasibility of ozone oxidation and limestone neutralization of Acid Mine Drainage (AMD) was performed. The study concludes that an ozone process is feasible, compares economically with existing processes, and offers potential advantages in process control, reduced neutralization costs, and simplified AMD sludge handling and disposal. Ozone production by electric discharge and radiation processes are compared both for on-site and central plant installations utilizing ozone shipping and storage facilities. A central chemonuclear ozone production plant with a distribution system is found to be most economical, followed by electric discharge central and on-site plants. Design and construction of a mobile pilot plant which employs electric discharge ozonizers is recommended for field trials of the process.
W71-06250

PROBLEM OF FLOOD-CONTROL IN SMALL BASINS,
For primary bibliographic entry see Field 07C.
W71-06298

ALL YOU SEE IS THE STREAM,
H. S. Hulme, Jr.
Am City, Vol 85, No 3, p 77-78, Mar 1970.

Descriptors: *Drainage systems, *Stream improvement.
Identifiers: Swales, Storm sewers, Arlington County, Virginia.

A controlled stream was constructed above a reinforced-concrete storm sewer enclosing Pimmet Run in Arlington County, Va. to prevent erosion upstream while retaining the aesthetic value of the stream downstream. Swales created along the stream carry local drainage and overflow from storms into the main culvert. Methods of construction and problems encountered are explained. Dimensions and costs of the system are included.
W71-06380

STRUCTURES PREVENT URBAN SEDIMENT DAMAGE,
Stephen M. Boysen.
Public Works, Vol 100, No 8, p 116-117, Aug 1969. 3 fig.

Descriptors: *Design, *Construction, *Settling basins, *Storm runoff, Performance, Operations research, Sediment control.

District of Columbia area engineers and the USCA Soil Conservation Service jointly worked to improve sediment basin design. These basins prevent damages originating from soils disturbed by intensive construction. Their purpose is to trap eroding soil and keep it on or near its original site while earth-movers do grading for new developments. These structures are temporary, but they protect stream-channels, impoundments, roads, etc. from damaging sediment. A typical sediment basin holds ponded runoff from which soil particles settle as water passes slowly into a vertical drain shortly after a heavy rain. Details regarding construction and performance are discussed. The fundamental design problem of striking a balance between detention time and economical basin size is also explored. Effectiveness of these basins is proven by the increasing number of counties employing the structures in the metropolitan Washington and Baltimore areas.
W71-06425

POLLUTION BY SEDIMENT: SOURCES AND THE DETACHMENT AND TRANSPORT PROCESSES,
Iowa State Univ., Ames. Dept. of Agricultural Engineering; and Agricultural Research Service, Beltsville, Md. Water Conservation Research Div.
For primary bibliographic entry see Field 05B.
W71-06430

CHEMISTRY OF SEDIMENT IN WATER,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div; and Minnesota Agricultural Experiment Station, St. Paul.

For primary bibliographic entry see Field 05B.
W71-06431

LAND AND WATER MANAGEMENT FOR MINIMIZING SEDIMENT,
Iowa State Univ. Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05G.
W71-06432

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

POLLUTION FROM MINES IN THE 'NEW LEAD BELT' OF SOUTH EASTERN MISSOURI,
Missouri Univ., Rolla. Dept. of Environmental Health; and Missouri Univ., Rolla. Dept. of Geochemistry.
Bobby G. Wixson, Ernst A. Bolter, Nicholas H. Tibbs, and Anthony R. Handler.
Available from NTIS as PB-198 042, $3.00 in paper copy, $0.95 in microfiche. Paper presented at the 24th Annual Purdue Industrial Waste Conference, May 7, 1969. 25 p, 9 fig, 1 tab, 16 ref. OWRR Projects A-021-MO (2) and B-021-MO (3).

Descriptors: *Water pollution sources, *Mine wastes, *Heavy metals, *Mining, *Missouri, Copper, Surface waters, Streams, Water quality, Methodology, Chemical analysis, Mine water, Ecology, Fish, Pollutant identification.
Identifiers: *Lead mining (Mo), Zinc.

In the southeastern part of Missouri, the Clark National Forest straddles the Ozark Plateau and contains the headwaters of some of the most scenic rivers in the state. In 1955, rich mineral deposits were discovered in this area and by 1962 a rich lead-zinc ore belt was found to extend for approximately thirty-six miles almost due south from Viburnum, Missouri, through Iron and Reynolds Counties. The name given this new ore district was the Viburnum Trend or the 'New Lead Belt'. This study for this report is concerned with the change of water quality and ecology of streams receiving the mining wastes. Heavy metal studies indicated that the range of values for copper, lead and zinc were from 1-20 ppb (parts per billion). The most frequently occurring values for all 3 elements were from 4-6 ppb. No significant changes in water quality were found for dissolved oxygen, alkalinity, hardness or stream temperature. Recommendations are presented for future stream pollution abatement in the 'New Lead Belt'. (See also W71-04182) (Woodard-USGS)
W71-05837

RADIOCHEMICAL ANALYSES OF WATER FROM SELECTED STREAMS, WELLS, SPRINGS, AND PRECIPITATION COLLECTED PRIOR TO REENTRY DRILLING, PROJECT RULISON,
Geological Survey, Denver, Colo.
Paul T. Voegeli, Sr., and Hans C. Claassen.
Prepared for Nevada Operations Office, US Atomic Energy Comm. Geological Survey Open-file Report USGS-474-83 (Rulison-6), 1971. 16 p, 1 fig, 4 tab, 2 ref. USAEC Agreement No AT (29-2)-474

Descriptors: *Radiochemical analysis, *Surface waters, *Groundwater, *Colorado, *Data collections, Radioactivity, Tritium, Uranium radioisotopes, Solubility, Sampling, Methodology, Chemical analysis, Investigations, Laboratory tests, Test procedures, Water analysis, Streams, Lakes, Hydrologic data, Equations.
Identifiers: Gross alpha radioactivity, Gross beta radioactivity.

The U.S. Geological Survey established a water sampling network in central and western Colorado on behalf of the U.S. Atomic Energy Commission to sample the hydrologic environment prior to and during the reentry drilling and the gas-production test phase of Project Rulison, an experiment to stimulate gas production from a low yield reservoir by a nuclear explosion. Samples obtained from selected streams, wells, springs, and from precipitation are analyzed for tritium, gross alpha, and gross beta activity. The analyses are made in laboratories of the U.S. Geological Survey, Denver, Colorado. This report contains data from analyses of samples from the network collected prior to reentry drilling (started April 28, 1970), including sample data obtained both prior to and after the nuclear detonation. The data are intended to give representative values over approximately a 1-year period and to show variations in natural radioactivity. (Woodard-USGS)
W71-05842

INVESTIGATIONS OF DAILY VARIATIONS IN CHEMICAL BACTERIOLOGICAL AND BIOLOGICAL PARAMETERS AT TWO LAKE ONTARIO LOCATIONS NEAR TORONTO, PART I--CHEMISTRY,
Ontario Water Resources Commission, Rexdale.
T. G. Brydges.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 750-759, 1969. 10 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Lake Ontario, *Water quality, *Monitoring, Bacteria, Water chemistry, Phosphorus, Nitrogen, Ammonia, Algae, Nutrients, Sewage, Waste water (Pollution), Water pollution sources, Municipal wastes, Great Lakes, *Pollutant identification.
Identifiers: *Toronto (Ontario).

An investigation of daily variations in chemical, bacteriological and algal parameters was carried out using samples collected five days a week from Toronto Harbour and from the intake of the R. C. Harris Filtration Plant. The intake extends 2500 m from shore and is 12 m deep in 23 m of water. The study began in July 1968. Weekly depth and sediment samples were collected to supplement the daily data. Fourteen chemical parameters were monitored. Total phosphorus concentration was the best indicator of the presence of urban drainage. Ammonia and organic nitrogen concentrations in the harbor vary inversely; consequently Kjeldahl nitrogen is a better measure of water quality than either of them. Surface nitrate concentrations vary with wind speed and biological activity and do not always reflect the effects of runoff. Chlorophyll and soluble phosphorus concentrations in the harbor vary inversely. Phosphorus was apparently not limiting algal growth, but there were insufficient data to test the relationship for the open lake. Daily data were required to define some inter-parameter relationships which were not defined by data collected at weekly intervals. (See also W71-05561) (Knapp-USGS)
W71-05879

TRACE ELEMENTS IN LAKE ERIE,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
V. K. Chawla, and Y. K. Chau.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 760-765, 1969. 6 p, 4 fig, 2 tab, 10 ref.

Descriptors: *Water chemistry, *Trace elements, *Lake Erie, Distribution patterns, Copper, Iron, Sampling, Data collections, Great Lakes, Lakes, Variability, Water quality, *Pollutant identification.
Identifiers: Lead, Zinc, Lithium, Nickel.

The data on trace elements obtained from cruises during the period June to October 1967 Lake Erie were examined to study their concent tions and distributions both horizontally and ve cally. Of the 11 elements studied, the concent tions of cadmium, chromium and cobalt w below the detection limits. The annual aver values of iron, manganese, strontium and copper surface waters were comparatively higher than average of some fresh water lakes of North Am ica. Concentrations of zinc, nickel, lithium and le were quite comparable. The horizontal distril tions of copper, zinc, nickel, lithium and lead w uniform in the main water body of the weste central and eastern basins. Iron and mangan were higher in the western and central than eastern basins, however, strontium on the contr was lower in the western basin. (See also W7 05561) (Knapp-USGS)
W71-05880

SOME VARIATION IN THE QUALITY WATER FROM THE SOURCE AND MOUTH THE NIAGARA RIVER,
State Univ. of New York, Buffalo. Dept. of Biolo
Thomas H. Sibley, and K. M. Stewart.
In: Proceedings Twelfth Conference on Gr Lakes Research, May 5-7, 1969, University Michigan, Ann Arbor: International Associati for Great Lakes Research, p 774-785, 1969. 12 p fig, 1 tab, 30 ref.

Descriptors: *Lake Ontario, *Lake Erie, *Wa quality, *Water pollution sources, Hardn (Water), Potassium, Sodium, Chlorides, Dissolv oxygen, Hydrogen ion concentration, Alkalini Water temperature, Great Lakes, Magnesiu Streamflow, Solutes, Path of pollutants, Water p lution effects.
Identifiers: *Niagara River.

An investigation in 1967 and early 1968 compar similarities and differences in selected variables water quality from the source and mouth of t Niagara River. The source of the River is the lar volume discharge from Lake Erie and the mouth the point at which this discharge empties into La Ontario. Industrial and municipal wastes and so runoff from agricultural areas are discharged in the river along portions of Western New Yo (USA) and Ontario (Canada). Comparisons we made of temperature, dissolved, oxygen, pH, har ness, alkalinity, calcium, magnesium, sodiu potassium, chlorides, total residue, fixed solids a conductivity. Chlorides and conductivity were co tinuously higher at the mouth. The mean values all parameters, except total residue and fixe solids, were slightly higher at the mouth. Althou the increases were relatively slight, the discharg from Lake Erie is so great that even slight chang in water quality between the source and mou represent impressive inputs into the river. (See al W71-05561) (Knapp-USGS)
W71-05881

DISSOLVED MINERAL QUALITY OF GREA LAKES WATERS,
Department of Energy, Mines and Resource Burlington (Ontario). Canada Center for Inlan Waters.
R. R. Weiler, and V. K. Chawla.
In: Proceedings Twelfth Conference on Grea Lakes Research, May 5-7, 1969, University o Michigan, Ann Arbor: International Associatio for Great Lakes Research, p 801-818, 1969. 18 p, fig, 5 tab, 15 ref.

Descriptors: *Water quality, *Water chemistry *Water pollution sources, *Great Lakes, Trace ele ments, Solutes, Chlorides, Calcium, Magnesium Sodium, Potassium, Sulfates, Bicarbonates Fluorine, Sampling, Industrial wastes, Lake Superi or, Lake Huron, Lake Erie, Lake Ontario, Monitor ing, Data collections, Path of pollutants.
Identifiers: *Water quality monitoring.

In 1968 the Canada Center for Inland Waters (C-CIW) undertook a systematic monitoring of Lakes Ontario, Erie, Huron and Superior in a study of the major (Ca, Mg, Na, K, SO4, Cl, HCO3 and F) and trace (Zn, Cu, Pb, Fe, Ni, Cr, Mn and Sr) elements. The data gathered on major elements during the period July to November 1968 were examined and the results compared on a lake-wide basis with earlier compilations to appraise recent trends and changes in the composition of these waters. Because the concentrations of all major ions for which data are available in Lake Superior have not changed for the last 70-80 years, their levels are apparently controlled by the balance between the amount of dissolved substances added by runoff from the drainage basin and that lost through St. Mary's River. Chloride and sulphate have increased in Lakes Michigan and Huron. This increase is most likely caused by human activities. In Lakes Erie and Ontario, all the major ions except bicarbonate and magnesium have shown a dramatic increase since 1910. Previous to that, the Lakes were essentially unaffected by human activities. The median values of minor elements (except-ng Sr) is generally below 10 micrograms/liter in he Great Lakes. Sorption by oxides of manganese nd iron and by suspended organic and inorganic naterial seems a plausible mechanism for the emoval of minor elements from the lakes. (See lso W71-05561) (Knapp-USGS)
V71-05883

LANKTON REDUCTION IN THE REVERSED LOW WATERWAYS OF THE IETROPOLITAN SANITARY DISTRICT OF REATER CHICAGO,
letropolitan Sanitary District of Greater Chicago, .

or primary bibliographic entry see Field 05B.
71-05924

HEMICAL CHARACTERIZATION OF BOT-OM SEDIMENTS,
nvironmental Protection Agency, Cincinnati, hio. Water Quality Office.
. G. Ballinger, and G. D. McKee.
urnal Water Pollution Control Federation, Vol , No 2, 216-227, Feb 1971. 6 figs, 4 tab, 16 ref.

escriptors: *Bottom sediments, *Chemical analy-, Organic carbon, Organic nitrogen, Water pollu-on, *Sediments, Pollutant identification.
entifiers: Red River, Kanawha R., Mississippi R, aritan Bay, Cooper River, Lake Sebasticock, aterville Reservoir.

boratory examination of more than 200 sedi-ents, using dichromate oxidation for organic car-n and Kjeldahl determination for organic rogen, resulted in the development of an Or-nic Sediment Index. Correlation of the OSI with ste loading and flow characteristics was demon-ated for two eutrophic lakes, three rivers, and o estuaries.
71-05981

VESTIGATIONS OF THE TECHNIQUES OF RIFICATION OF ALGAL CULTURES: ABORATION OF METHODS APPLICABLE DESMIDS, FILAMENTOUS ANOPHYTES, AND DIATOMS, (IN ENCH),
ntre National de la Recherche Scientifique, Gif--Yvette (France). Centre de Recherches drobiologiques.
primary bibliographic entry see Field 07B.
1-06002

ALUATION OF AN AUTOMATIC CHEMI-L ANALYSIS MONITOR FOR WATER ALITY PARAMETERS,
w York State Dept. of Health, Albany. Div. of s and Research.
es E. O'Brien, and Rolf A. Olsen.

Journal Water Pollution Control Federation, Vol 42, No 3, Part 1, p 380-390, 1970. 7 fig, 3 tab, 4 ref.

Descriptors: *Monitoring, *Water quality, *Chemical analysis, Data collections, Control systems, Measurement, Colorometry, Automatic control, Data processing, New York.
Identifiers: *CSM-12, Hudson River (NY).

The effectiveness was evaluated of a monitor to collect samples from a continuously pumped stream representative of surface water and analyze them automatically on a continuous or intermittent basis for 12 specific parameters of water quality; and to evaluate the equipment when used in conjunction with an electronic data processing system and computer. After over a year's usage it was concluded the particular equipment was not satisfactory for the designed purpose for the following reasons: No provision is made within the analytical system to compensate for interference of color and suspended matter in determining certain parameters. No satisfactory method was provided to prevent or compensate for baseline drift and, in the absence of computer control, there could be no external compensation. Mechanical and electrical solenoid valve failure prevented acceptable results for five months; their replacements also failed. No practical method was provided to prevent algae and slime growths. Friction-fitting connectors frequently failed; leakage required cleaning operations. Without extensive instrument modification correcting these deficiencies, it would be futile to evaluate the equipment in conjunction with an electronic data processing system and computer. (Jones-Wisconsin)
W71-06005

HEAVY METAL POLLUTION: POLICY AND PROGRAM IMPLICATIONS FOR THE PROTECTION OF THE ECOSYSTEM,
Department of Fisheries and Forestry, Ottawa (Ontario).
K. C. Lucas.
Presented at Special Symposium on 'Mercury and Man's Environment', February 15 and 16, 1971, Royal Society of Canada, Ottawa. Typescript, 12 p.

Descriptors: *Heavy metals, *Toxicity, *Public health, Environmental engineering, Water pollution, Fish, Mining, Industrial wastes, Iron.
Identifiers: *Mercury, Mercury pollution, Acceptable daily intake, Metal effects.

Three levels of toxicity of heavy metals can be distinguished. The heavy metals discharged into the environment are persistent, essentially indestructible elements. Some of the trace metals are necessary nutrients for the well being of organisms. Others are toxic. Little synergism has been found between heavy metals at the low concentrations. Means of controlling heavy metals pollution are discussed from the point of view of governmental agencies. The control program of Canada is outlined. The major program implications of the problem of control of heavy metal pollution are in the areas of regulation, monitoring and research. (Novotny-Vanderbilt)
W71-06078

ACTIVITIES OF THE FOOD AND AGRICULTURE ORGANIZATION AND THE WORLD HEALTH ORGANIZATION REGARDING MERCURY,
Department of National Health and Welfare, Ottawa (Ontario).
D. G. Chapman.
Presented at Symposium on 'Mercury and Man's Environment', February 15 and 16, 1971, Royal Society of Canada, Ottawa. Typescript, 7 p.

Descriptors: *Heavy metals, *Toxicity, *Human pathology, Metals, Inorganic compounds, Organic compounds, Environmental engineering, Fish, Food chains, Foods.
Identifiers: *Mercury, Acceptable daily intake, Mercury pollution, Organic mercury.

The effort of the international organizations, the Food and Agriculture Organization, and the World Health Organization, to define and establish an acceptable daily intake for mercury and a tolerance for mercury on food products is discussed in the paper. It was suggested that the background levels (practical residue limits) of mercury in foods amount to 0.02 to 0.05 ppm. Officially the two agencies of the United Nations have not found it possible to establish an acceptable daily intake for mercury and hence have not recommended tolerances for mercury in food. (Novotny-Vanderbilt)
W71-06079

AN INTERFEROMETRIC TECHNIQUE FOR TEMPERATURE AND CONCENTRATION MEASUREMENT FOR AN AIR-WATER INTERFACE,
Virginia Univ., Charlottesville.
C. Prasad, C. S. Chen, and J. T. Beard.
Journal of Basic Engineering, Transaction ASME, Paper No 70-WA, Temp-1, 1970. 6 p.

Descriptors: *Heat transfer, *Mass transfer, *Measurement, *Instrumentation, Temperature, Temperature control, Air-water interfaces, Boundary processes, Evaporation, Convection, Diffusion.
Identifiers: Temperature measurement, Mass transfer measurement.

A new technique for the measurement of temperature and concentration for a simultaneous heat and mass transfer analysis is described. The technique employs a one wavelength Mach-Zehnder interferometer with an additional noninterferometric measurement of temperature or concentration. This overcomes the difficulties encountered in other interferometric techniques used for simultaneous heat and mass transfer analysis such as two wavelength technique and one wavelength technique with the assumption of Lewis number being unity. Computational formulas were developed by which either temperature or concentration can be calculated from the interferograms. An air-vapor boundary layer formed due to heated water and ambient air sent in parallel flow was analyzed with this technique. Better results in the air-water system were obtained for the concentration from interferogram analysis with the temperature measured by another technique. (Novotny-Vanderbilt)
W71-06090

THERMAL CRITERIA - A MEASURE TO CONTROL THERMAL POLLUTION,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 05C.
W71-06096

THE FACTS BEHIND THE MERCURY,
James T. Parker.
Popular Science, p 62-63, December 1970.

Descriptors: *Heavy metals, *Water pollution, *Path of pollutants, Toxicity, Public health, Fish, Environmental engineering, Water pollution effects, Bottom sediments, Aquatic microorganisms, Pollutant identification, Chemical wastes.
Identifiers: Metals effects, Mercury, Mercury pollution, Organic mercury.

In 1969, Canadian authorities discovered mercury levels of 10 ppm in fish from Lake St. Clair and the Lake Erie region. The maximum level in food deemed safe for human consumption is 0.5 ppm and in water 0.5 ppb. The mercury present is in form of methyl-mercury which is 100 times more toxic than metalic mercury. The mechanism of transferring metalic mercury into its organic form is a complex process accomplished by the action of microorganisms in bottom sediments and rotten fish. The length of active life of mercury-contaminated sediments in lakes and rivers is not known. About 78,000 flasks of mercury of 76 pounds each were consumed in the United States in 1969 with 26% used by factories making chlorine

and caustic soda. The technique of detecting mercury is discussed. (Novotny-Vanderbilt)
W71-06100

DEVELOPMENT OF AN INSTRUMENT FOR MEASURING THE CONCENTRATION OF DISSOLVED OXYGEN IN SEA WATER IN SITU,
Hawaii Inst. of Geophysics, Honolulu.
Volker Grafe.
Available from NTIS as PB-196 145, $3.00 in paper copy, $0.95 in microfiche. Report HIG-70-29, November 1970. 20 p, 9 fig, 6 ref. WSF Grant No GA-779.
Identifiers: *Sea water, Oxygen, *Dissolved gases, Measurement, Accuracy, Ocean bottom, Telemetering equipment, Digital systems, Oxygen sensors.

An instrument is described consisting of a commercially available oxygen sensor and of a newly developed telemetering and digitizing system which permits measurement of the concentration of dissolved oxygen even in great oceanic depths. The instrument employs a frequency modulation telemetry scheme and is compatible in its frequency range and its power requirements with the Bisset-Berman TDS-recorder. The accuracy of the instrument is determined by the accuracy of the oxygen sensor.
W71-06104

WATER QUALITY OF THE DELAWARE RIVER ESTUARY, JULY THROUGH DECEMBER 1967,
Geological Survey, Washington, D.C.

Geological Survey open-file report 1970. 84 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Water quality, *Delaware River, *Estuaries, *Hydrologic data, *Data collections, Chemical analysis, Tides, Tidal waters, Sampling, Boats, Chemical properties, Salinity, Dissolved solids, Dissolved oxygen, Water chemistry, Biological properties.
Identifiers: Analytical data (Tables).

Samples collected from the Delaware river were taken three feet below the water surface at the center of the navigation channel by boat at 17 selected stations extending from Reedy Island, Del., to Fieldsboro, N. J., about 6 miles below the head of tide at Trenton, N. J. Sampling runs were made at approximately weekly intervals. For each run, the boat began at the farthest downstream station and proceeded upstream. Samples were collected at each station at slack tide. About two-thirds of the runs were made at low-water slack and the remainder at high-water slack. Samples were analyzed for over 30 water-quality parameters. Tables present the analytical data obtained during the first 6 months of the program, covering the last half of 1967. The data were retrieved and printed out by computer. Four tables are presented for each station--two tables of analytical results and two of statistical summaries. Maximum observed chloride concentrations ranged from 15 to 20 mg/liter above river mile 110, increasing to 50 mg/liter between river miles 85 and 90, and to 7,500 mg/liter at river mile 55. During the summer season dissolved oxygen concentrations ranged from a maximum of 9 mg/liter to a minimum of less than 1 mg/liter. The higher values were observed in the upper and lower portions of the Estuary and the lowest values were observed in the reach between river miles 70 and 100. (Woodard-USGS)
W71-06156

A PORTABLE MULTIPARAMETER WATER QUALITY KIT,
Geological Survey, Menlo Park, Calif.
Keith V. Slack.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1395-1399, July 1970. 5 p, 3 fig, 2 ref.

Descriptors: *Water quality, *On-site tests, *Water analyses, Instrumentation, Sampling, Testing, Hydrogen ion concentration, Dissolved oxygen, Electrical conductance, Water temperature.
Identifiers: *Field water-analysis kit.

A kit was assembled from commercial units for instrumental measurement of four water quality properties on grab samples or in situ in streams and shallow lakes. The water quality kit consists of an instrument package and an accessory package. The instrument package contains all equipment needed for measurements of temperature, pH, DO, and specific conductance on water samples or at near-surface depths. The accessory package contains supplies and equipment for several supplementary quality determinations and extends the capability of temperature, DO, and conductance measurements to depths of 35 m. A device is included for taking water samples from the surface to depths of at least 15 to 20 m. The compact size of the equipment is well suited to field use or to transporting as luggage on commercial carriers. The cost will vary with the particular models used, but in the present example was about $750 for the instrument package and $100 for the accessory package. (Knapp-USGS)
W71-06157

WATER QUALITY AT THE DADE-COLLIER TRAINING AND TRANSITION AIRPORT, MIAMI INTERNATIONAL AIRPORT, AND COTTONMOUTH CAMP-EVERGLADES NATIONAL PARK, FLORIDA, NOVEMBER, 1969,
Geological Survey, Tallahassee, Fla.
Benjamin F. McPherson.
Geological Survey open-file report No 70011, 1970. 29 p, 2 fig, 9 tab, 7 ref.

Descriptors: *Water pollution sources, *Airports, *Florida, *Urbanization, Pesticides, Oily water, Solutes, Nitrogen, Phosphorus, Organic matter, Heavy metals, Path of pollutants, Water pollution effects.
Identifiers: *Everglades, *Miami (Fla).

Water quality was determined at three areas in south Florida in November 1969 to compare conditions at a commercial jetport (Miami International Airport), and in a natural environment (Cottonmouth Camp in Everglades National Park) and a transitional environment (Dade-Collier Training and Transition Airport). Water in canals near Miami International Airport generally contained more nitrogen, phosphorus, organic carbon, trace elements and heavy metals, and less dissolved oxygen than waters at the other areas. Concentrations of chromium, lead, and oil in surface water at Miami International Airport exceeded the limits established by the Federal Water Quality Administration; concentrations were below these limits in the other areas. Sediment at Miami International Airport was heavily coated with oil and grease (23%) at station 5, and contained 85.2 micrograms per kg on the DDT family at station 1. Sediment at other stations contained less than 3.0% oil and grease and less than 4.2 micrograms/kg of the DDT family. (Knapp-USGS)
W71-06158

METHODS FOR CHEMICAL ANALYSIS OF FRESH WATERS.
Hydrobiologisch Instituut, Nieuwersluis, (Netherlands); and Westfield Coll., London (England).
For primary bibliographic entry see Field 02K.
W71-06159

THE MONOCACY RIVER-PHYSICAL, CHEMICAL AND BACTERIOLOGICAL WATER QUALITY REPORT NUMBER 1, MARCH-DECEMBER 1966,
Maryland Dept. of Water Resources, Baltimore. Div. of Water Quality Investigations.
For primary bibliographic entry see Field 05B.
W71-06176

MONTHLY VARIATION IN PHOSPHATE AND RELATED CHEMICALS FOUND IN THE SEDIMENT IN THE ISLAND AREA OF LAKE ERIE, 1967-68, WITH REFERENCE TO SAMPLES COLLECTED IN 1964, 1965, and 1966,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 05B.
W71-06187

MAYFLY DISTRIBUTION AS A WATER QUALITY INDEX,
Winona State Coll., Minn.
Calvin R. Fremling.
Copy available from GPO Sup Doc as No 16030 DQH, Nov 15, 1970, $0.50; microfiche from NTIS as PB-198 223, $0.95. EPA-WQO Final Report No 16030 DQH, Nov 15, 1970. 39 p, 18 fig, 54 ref. WP00987.

Descriptors: Mayflies, Water quality, Indicators, Water pollution effects, Mississippi River.
Identifiers: Hexagenia, Pentagenia.

Three species of burrowing mayflies (Hexagenia bilineata, Hexagenia limbata, and Pentagenia vittigera) are sufficiently abundant to cause nuisance problems along portions of the Mississippi River. Mayfly distribution, as determined by collections made by ship captains and other cooperators over a 13-year period, has proven to be an excellent index of general water quality on a river which is so large that is cannot be monitored effectively or economically by standard methods. Pollutants have severely reduced the numbers of all three species for 30 miles below Minneapolis, Minnesota, and for over 300 miles below St. Louis, Missouri. P. vittigera is able to emerge only in early and late summer in the St. Louis area when cool water temperatures lessen toxic effects in the zone of degradation. Impoundment and enrichment of the Upper Mississippi River has temporarily increased the carrying capacity of the river for H. bilineata which now dominates areas formerly dominated by H. limbata. The total productivity of the Upper Mississippi is being reduced by pollution, man's encroachment into the flood plain and by the filling of navigation pools by sand. Methods have been developed to rear large numbers of Hexagenia nymphs in the laboratory. Bioassay tests utilizing artificial, burrow-containing substrates reveal that H. bilineata nymphs can survive anaerobic conditions for as long as 11 hours. TLm values for hydrogen sulfide varied from 0.42 ppm at 48 hr to 0.17 ppm at 96 hr. Of several heavy metals (Cr, Ni, Zn, Cu) tested, copper was the most toxic to H. bilineata nymphs. TLm values for copper ranged from 0.54 ppm at 12 hr to 0.22 ppm at 48 hr.
W71-06248

CHARACTERIZATION OF OIL SLICKS ON SURFACE WATERS,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
F. K. Kawahara, and D. G. Ballinger.
Industrial and Engineering Chemistry, Product Research and Development Quarterly, Vol 9, No 4, p 553-558, 1970. EPA-WQO Project 1602.

Descriptors: *Infra-red, *Radiation, *Oil wastes, *Oily water, *Asphalt, Absorption, Pollution identification.

Ratios of infrared absorption from unidentified petroleum pollutants are compared with those from industrial asphalts and residual fuel oils. Asphalts, No. 6 fuel oils, No. 5 fuel oils, and lubricating oils were characterized. Supplemental analyses - API gravity, solubility behavior, distillates - supplement the initital classification by the RIA technique. (Kawahara-EPA/WQO)
W71-06261

AN ELECTRODE CHAMBER FOR RECORDING RESPIRATORY AND OTHER MOVEMENTS OF FREE-SWIMMING ANIMALS,
National Water Quality Lab., Duluth, Minn.

W. A. Spoor, T. W. Neiheisel, and R. A. Drummond.
Trans Amer Fisheries Soc Vol 100, No 1, p 22-28, 1970. 5 fig, 19 ref. Project No 18050 WAE 01/71, Grant No WP-01317-01.

Descriptors: *Fish behavior, *Fish physiology, *Electronic equipment, Remote sensing, Water pollution effects, Aquatic invertebrates, Laboratory equipment, Laboratory animals.
Identifiers: *Electrode chamber, Electrode design.

The occurrence of potential differences in the microvolt range between stainless steel electrodes immersed in water at opposite ends of an animal chamber can be related clearly to respiratory and other movements of animals moving freely in the water. The differences are attributed to the effects of water currents on the equilibrium potentials of the electrodes. The chamber can be large or small, according to the size of the animal. Changes over the biological range in such variables as temperature, dissolved oxygen concentration, free carbon dioxide and pH do not interfere; neither do metals in dilute solution, or non-electrolytes. Inorganic salts affect electrode sensitivity, but not seriously in fresh water, and the method can be made to work in sea water.
W71-06328

CHEMISTRY OF NITROGEN IN SOILS,
Illinois Univ., Urbana. Dept. of Agronomy; and Missouri Univ., Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W71-06436

CHEMISTRY AND METABOLISM OF INSECTICIDES,
Iowa State Univ., Ames. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 05C.
W71-06438

THE PESTICIDE BURDEN IN WATER AND ITS SIGNIFICANCE,
Federal Water Pollution Control Administration, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05B.
W71-06439

5B. Sources of Pollution

POLLUTION FROM MINES IN THE 'NEW LEAD BELT' OF SOUTH EASTERN MISSOURI,
Missouri Univ., Rolla. Dept. of Environmental Health; and Missouri Univ., Rolla. Dept. of Geochemistry.
For primary bibliographic entry see Field 05A.
W71-05837

WATER CHEMISTRY OF TOXAPHENE - ROLE OF LAKE SEDIMENTS,
Wisconsin Univ., Madison. Water Chemistry Lab.
Gilman D. Veith, and G. Fred Lee.
Environmental Science and Technology, Vol 5, No , p 230-234, March 1971. 5 p, 1 fig, 4 tab, 20 ref.

Descriptors: *Path of pollutants, *Bottom sediments, *Pesticides, *Chlorinated hydrocarbon pesticides, Mixing, Leaching, Laboratory tests, Clay minerals, Water chemistry, Biodegradation.
Identifiers: *Toxaphene.

The role of lake sediments in the detoxification of lakes which were treated with toxaphene was evaluated under environmental and laboratory conditions. The extent of toxaphene accumulation in sediments of three Wisconsin lakes was determined by electron capture gas chromatographic analysis of core sections and Ekman dredge samples. The toxaphene concentration in the 0 to 5-cm level of the sediment increased for 190 days following the treatment of the lakes and then began decreasing by a factor of 2 every 120 days. Toxaphene was transported vertically to the 5 to 10-cm and the 10 to 15-cm level of the sediment at rates varying from 0.4 to 1.1 cm per day in the three lakes. Toxaphene was not detected below the 20-cm level of the sediments. Toxaphene which was sorbed onto the sediment in the lake could not be leached from the sediment by lake water under laboratory conditions. (Knapp-USGS)
W71-05840

MERCURY USES IN CANADA AND THEIR POSSIBLE HAZARDS AS SOURCES OF MERCURY CONTAMINATION,
University of Western Ontario, London. Dept. of Zoology.
Norvald Fimreite.
Financed by contract with Canadian Wildlife Service. Environmental Pollution, Vol 1, No 2, p 119-131, October 1970. 13 p, 4 fig, 1 tab, 38 ref.

Descriptors: *Water pollution sources, *Surface waters, *Heavy metals, *Industrial wastes, Inorganic compounds, Streams, Lakes, Aquatic habitats, Fishkill, Wildlife, Birds, Ecology, Environmental effects, Soils, Plants, Industrial production, Chlorine, Seeds, Poisons, Water pollution effects.
Identifiers: *Mercury, *Mercury contamination (Canada).

During the past ten years mercury consumption has shown a strong upward trend in Canada. The major proportion of this increase can be accounted for by the chloralkali industry, from which nearly 200,000 lbs of mercury are released into the environment each year. Most of this mercury finds its way to watercourses exposing aquatic ecosystems where mercury is known to accumulate. The use of mercury compounds for slime control in the Canadian pulp industry is decreasing, but in one case elevated mercury levels in fish were traced back to such a source. Also decreasing is the use of seed-dressings containing mercury, although this use of mercurials is still considerable, and in view of findings in other countries elevated mercury levels in seed-eating birds and their predators must be expected. Elevated levels of mercury were found in pheasants and partridges collected in Southern Alberta where mercury seed-dressings are extensively used. (Woodard-USGS)
W71-05861

DIFFUSION FROM A CONTINUOUS SOURCE IN A UNIFORM SHEAR FLOW,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Akira Okubo, and Michael J. Karweit.
Limnology and Oceanography, Vol 14, No 4, p 514-520, July 1969. 7 p, 5 fig, 16 ref. USAEC Contract AT (30-1)-3109; ONR Contract Nonr 4010 (11).

Descriptors: *Diffusion, *Dispersion, *Mixing, *Path of pollutants, Flow, Diffusivity, Non-uniform flow, Turbulant flow, Shear, Mathematical models.
Identifiers: *Shear flow.

The importance of velocity shear in the diffusion of a patch of passive contaminant from an instantaneous source is well recognized. Shear also plays an important role in the spread of contaminant from a continuous source. A model for the diffusion of a dynamically passive contaminant from a continous source is presented. This source is superposed on a mean flow with uniform shear. An equation is derived which shows by numerical solution that the maximum concentration of the contaminant in the resulting plume decreases nearly as the reciprocal of the distance. Small and large time approximations verify this result analytically. The skewness of the concentration distribution at various distances from the source is also analyzed. This diffusion model compares favorably with diffusion experiments conducted in seas and lakes. (Knapp-USGS)
W71-05872

REMOVAL OF CONTAMINANTS FROM LAKE ONTARIO BY NATURAL PROCESSES,
Canadian Oceanographic Data Centre, Ottawa (Ontario).
For primary bibliographic entry see Field 05G.
W71-05878

INVESTIGATIONS OF DAILY VARIATIONS IN CHEMICAL BACTERIOLOGICAL AND BIOLOGICAL PARAMETERS AT TWO LAKE ONTARIO LOCATIONS NEAR TORONTO, PART I--CHEMISTRY,
Ontario Water Resources Commission, Rexdale.
For primary bibliographic entry see Field 05A.
W71-05879

SOME VARIATION IN THE QUALITY OF WATER FROM THE SOURCE AND MOUTH OF THE NIAGARA RIVER,
State Univ. of New York, Buffalo. Dept. of Biology.
For primary bibliographic entry see Field 05A.
W71-05881

SURFACE WATER INPUTS OF IODINE, BROMINE, AND CHLORINE TO LAKE HURON,
Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography; and Michigan Univ., Ann Arbor. Great Lakes Research Div.
Mary A. Tiffany, and John W. Winchester.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 789-800, 1969. 11 p, 3 fig, 10 tab, 12 ref, 2 append. AEC Contract AT (11-1)-1705.

Descriptors: *Water pollution sources, *Lake Huron, *Halogens, *Great Lakes, Chlorine, Chlorides, Path of pollutants, Water balance, Salinity, Industrial wastes.
Identifiers: Bromine, Iodine, Saginaw River.

Surface waters were systematically sampled and analyzed for chlorine, bromine, and iodine by neutron activation for material balance calculation of inputs and outflows for Lake Huron. Saginaw River basin samples (42) from autumn 1968 showed marked halogen pollution, also detected in 11 Saginaw Bay samples. River water from 16 northern Michigan and Ontario locations was less polluted. Using these and previously published analyses, together with available rainfall and river discharge data, total input/outflow ratios for Lake Huron are: Cl, 1.04; Br, 1.73; I, 1.15. Cl and I are apparently near a steady state, but inflow of Br significantly exceeds outflow. If present inputs continue, the Br concentration will rise in Lake Huron, but Cl and I will remain roughly constant. Reducing Saginaw River halogen pollution, which supplies nearly half the Cl and Br input, should decrease Lake Huron Cl concentration and arrest the increase of Br concentration. (See also W71-05561) (Knapp-USGS)
W71-05882

DISSOLVED MINERAL QUALITY OF GREAT LAKES WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-05883

PLANKTON REDUCTION IN THE REVERSED FLOW WATERWAYS OF THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO,
Metropolitan Sanitary District of Greater Chicago, Ill.
Norman W. Youngsteadt.
Metropolitan Sanitary District of Greater Chicago, April 25, 1969. 32 p, 14 fig, 4 tab, 5 ref.

Descriptors: *Plankton, *Phytoplankton, *Water pollution, *Monitoring, *Water quality control, Sewage effluents, Waste water, Water analysis, Sampling, Illinois.
Identifiers: *Chicago.

A preliminary survey of the plankton of the reversed-flow waterways of the District, made in 1967, revealed a reduction in plankton concentration upon traveling downstream from the Lake Michigan inlets. At that time, it was thought the decrease in expected plankton concentrations could have resulted from death due to pollution, and the phenomenon of decreasing concentrations of plankton might thus be used to establish an index to the relative degree of pollution in the reversed flow waterways. A system of sampling was established and plankton was collected from the District's reversed flow waterways on October 14 and 15, 1968. Plankton were found to be reduced in concentration between Lake Michigan inlets and downstream portions to a greater extent than could be accounted for due to additions of non-plankton bearing water. Reduction patterns corresponded closely to those noted for samples collected in October of the previous year. It was concluded that these reductions were likely due to poor water quality conditions and that if water quality improved, future sampling would reveal a lesser degree of plankton reduction. The effectiveness of plankton reduction as a monitor of water quality will become known when pollution control measures are taken and pollution is reduced. If plankton reduction is simultaneously reduced, the method will be proved and development into a reliable tool for estimating relative water quality will be at hand. (Poertner)
W71-05924

GENESEE COUNTY ENVIRONMENTAL HEALTH, CONCLUSIONS REPORT, GENESEE COUNTY, MICHIGAN.
Genesee County Metropolitan Planning Commission, Flint, Mich.; and Battelle Memorial Inst., Columbus, Ohio.

Copies of report are available from: Genesee County Metropolitan Planning Comm., Flint, Mich.; and HUD Regional Office Library, 306 N. Michigan Ave., Chicago, Illinois 60601. Genesee County Metropolitan Planning Commission, Flint, Michigan, February 1970. 159 p, 15 fig, 73 ref. HUD Project No Mich P-155.

Descriptors: *Water pollution, *Water pollution sources, *Urbanization, *Water quality control, *Land use, *Water pollution control, Soil erosion, Waste water treatment, Sewerage, Public health, Environmental engineering, Michigan.
Identifiers: *Genesee County, *Flint, Environmental health.

This report examines the current status of pollution in the air, soil, and water sectors of the environment of Genesee County. Current and future programs at the federal, state, and local levels, and existing facilities are evaluated in terms of adequacy in controlling and preventing pollution problems found to be present in the three sectors of the environment. In addition to recommendations and conclusions on existing and proposed legislation and programs and existing facilities, the report contains recommendations regarding the relationship of land use planning to control and prevention of environmental pollution Genesee County to 1990. It was concluded that there is considerable water pollution in the county, particularly in the Flint River and tributaries entering in the City of Flint. Control of pollution requires, above all, construction and improvement of waste collection and treatment facilities to keep waste discharges at a level not detrimental to desired uses of the water. Prime factors contributing to water pollution include poor drainage, gentle channel slopes, low oxygen reaeration in streams, and the presence of swamps. Of all water pollution alternatives, direct treatment of waste discharges is presently the only effective means available within feasible cost limits. (See also W71-05933) (Poertner)
W71-05934

DISTRIBUTION OF TRACE METALS IN IMPOUNDMENTS,
Arkansas Univ., Fayetteville Resources Research Center.
J. Nix.
Available from NTIS as PB-198 089, $3.00 in paper copy, $0.95 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Publication No 6, January 1970. 194 p, 31 tab, 71 fig, 44 ref. OWRR Project B-002-ARK (2).

Descriptors: Water quality, *Trace elements, Reservoir, *Impoundments Arkansas, *Metals, Heavy metals, Iron, Copper, Cobalt, Lead, Chromium, Water pollution sources.
Identifiers: *Ouachita River (Ark), *Trace metals, Zinc, Nickel.

An investigation of the trace element content of two impoundments on the Ouachita River, Arkansas, was conducted. Common water quality parameters were followed in the reservoirs in an effort to determine the factors which were influencing the trace element concentration. The following trace metals were determined in both the particulate phase (retained by a 0.45 micron filter) and the soluble phase (passed by a 0.45 micron filter): iron, manganese, copper, cobalt, nickel, lead, chromium, and zinc. These measurements were made periodically for one and a half years. Results indicate that the chemical regime of the impoundments which were studied was greatly influenced by the cool water releases from an upstream impoundment. A cold density current throughout the entire main stem of the reservoir furnished dissolved oxygen to the lower portion of the impoundments and prevented the accumulation of large quantities of iron and manganese. More typical hypolimnic conditions were observed in the sidepockets of the reservoir. Data suggest that outside of hypolimnic zones in the reservoir, soluble iron is present in very small quantities, usually less than 10 ppb.
W71-05971

EFFECT OF FEEDLOT LAGOON WATER ON SOME PHYSICAL AND CHEMICAL PROPERTIES OF SOILS,
Kansas State Univ., Manhattan. Dept. of Agronomy, and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05C.
W71-05974

POLLUTION - ARE FERTILIZERS AT FAULT,
Maryland Univ., College Park. Dept. of Soils.
Fred P. Miller.
Crops and Soils Magazine, p 15-30, September 1970. 8 fig.

Descriptors: *Water pollution sources, *Fertilizers, *Agriculture, Nitrogen, Phosphorus, Nutrients, Runoff, Nitrification, Minnesota.
Identifiers: Potomac River (DC), Fort Wayne (Ind).

A comparison of non-farm contribution to water pollution indicates agriculture's share as neither alarmingly large nor, in many areas, important. Farm fertilizers do not appear to be the major contributors; most phosphates fed into the Mississippi River through sediments, are native to the soil itself and not the result of fertilization. Probably the greatest concern is the nitrogen loss from animal wastes. Most of the nutrients draining from farmlands accrue from these wastes and from spreading manure on frozen ground. Under recommended fertilization programs, the bulk of data seems to indicate that nitrogen losses through leaching are not significant on most cultivated soils and, generally, are much less than 10-20% of that applied. The present evaluation does not indicate that fertilizer usage is in serious violation of the ecological balance. Natural nitrification processes in the soil and nitrification of sewage effluent and animal wastes seem to be the major contributors to nitrates in groundwater. Many of Minnesota's eutrophied lakes are in areas completely isolated from agricultural watersheds. The case against fertilizers appears to have been overstated by many. (Jones-Wisconsin)
W71-05996

MAN-MADE SOURCES OF MERCURY,
National Swedish Environment Protection Board, Stockholm.
Arne Hanson.
Presented at Symposium on 'Mercury and Man's Environment', February 15 and 16, 1971, Royal Society of Canada, Ottawa. Typescript, 20 p.

Descriptors: *Heavy metals, *Water pollution, *Industrial wastes, Metals, Water pollution effects, Catalysts, Inorganic compounds, Pulp and Paper Industry, Public health, Environmental engineering, Chemical wastes, Agricultural chemicals, Food, Food chains.
Identifiers: Mercury pollution, Sources of mercury.

In Sweden today, the commercial harvesting of fish has been prohibited in more than sixty water areas due to the high level of mercury in fish. The sources of mercury are apparatus and instruments, manufacture of mercury compounds, the chlor-alkali industry, catalysts, dental use, recovery and purification of mercury, the paint industry, the pulp and paper industry, agricultural use, raw materials, and basic chemicals. The forms and compounds of mercury wasted from these processes are described. The following measures are recommended: prohibition of mercury use or restriction, changing or improving processing techniques, and improved water and air purification techniques. Approximately 500 tons of mercury have been deposited in the bottom sediments of Swedish waters. It is believed that the recycling of mercury from bottom sediments will be a major water pollution problem in the future. (Novotny-Vanderbilt)
W71-06077

THERMAL DISCHARGE: A MODEL - PROTOTYPE COMPARISON,
Pacific Gas and Electric Co., Emeryville, Calif. Engineering Research Dept.
R. M. Miner, P. D. Hindley, and R. F. Cayot.
ASCE National Water Resources Engineering Meeting, Phoenix, Arizona, Jan 11-16, 1971. 40 p, 20 fig, 1 tab.

Descriptors: *Thermal pollution, *Water temperature, *Model studies, *Prototypes, *Estuaries, Mixing, Instrumentation, Tides.
Identifiers: Thermal discharge, Infrared sensing.

Receiving water temperature distributions resulting from the thermal discharge of Pacific Gas and Electric Company's existing Pittsburg power plant, which is located on the San Francisco Bay tidal estuary, have been measured for several years. Both conventional and infrared temperature acquisition techniques have been used. It was desired to compare these distributions with those obtained by simulating the thermal discharge on the San Francisco Bay-Delta Model, which is operated by the Corps of Engineers. The photographs presented show that the model accurately reproduces the general features of the prototype cooling water discharge. Both qualitative and quantitative results indicate that the distorted model used in this case was capable of reproducing the relevant prototype processes with an accuracy sufficient for the study of a power plant thermal discharge problem. The differences between model and prototype results are due to certain limitations in the experimental procedures, and the inherent randomness of a turbulent mixing process. (Upadhyaya-Vanderbilt)
W71-06095

A STUDY OF THE BEHAVIOR OF OIL SPILLS IN THE ARCTIC,
Coast Guard, Washington, D.C. Applied Technology Div.
John L. Glaeser, and George P. Vance.
Available from NTIS as AD-717 142, $3.00 in paper copy, $0.95 in microfiche. Final Report, Feb 1971. 60 p, 18 fig, 3 tab, 6 ref. Project No 714108/A/001,002.
Identifiers: *Water pollution, *Oils, *Arctic regions, Water pollution, Petroleum, Combustion, Removal, Control, Ice, Aging (Materials), Adsorption, Sraw, Wind, Viscosity, *Oil pollution, Abatement, *Water pollution control.

A program to investigate the behavior of oil spills in the Arctic was conducted off the northern coast of Alaska in July 1970. Numerous small oil spills were made to obtain data on the following subjects: the spreading behavior of crude oil on ice and water surfaces; the interaction characteristics of crude oil with ice; the aging characteristics of crude oil which has been spilled on ice, on water, and under ice; and the effectiveness of burning and absorption as methods of removal. Both Prudhoe Bay ('Sag River) crude oil and diesel fuel were used in the test program. Results quantify spreading and interaction characteristics in addition to presenting qualitative information on each area of interest. Promise is shown for both burning and absorption as methods of oil removal in the summer. Data is presented on both the physical and chemical characteristics of aged crude oil.
W71-06101

SPECIAL STUDIES OF A SANITARY LANDFILL,
University of Southern California, Los Angeles.
Robert C. Merz, and Ralph Stone.
Available from NTIS as PB-196 148, $3.00 in paper copy, $0.95 in microfiche. Final Summary Report, 1970. 217 p, 15 fig, 21 tab. PHS Grant No UI-00518-08.
Identifiers: *Earth fills, *Refuse disposal, *Garbage disposal, Earth fills, *Sanitary engineering, Earth fills, Waste disposal, Aeration, Percolation, Anaerobic conditions, Aerobic processes, Gases, Compacting, Field tests, Rainfall intensity, Climate setting, *Sanitary landfills, *Solid waste disposal.

Model sanitary landfill cells were constructed and, over a 4.. year period, subjected to simulated environmental conditions such as added water, aeration, and aerobic and anaerobic operation. The effect of these conditions on percolation, gas quality and production, settlement, and temperature was measured. Examination of core samples taken at the end of the study period showed that refuse in the aerated cell was well decomposed except for plastics and other inerts and that refuse in the anaerobic cells was easily identifiable. Based on an original cell depth of 20 feet, volume reduction in the aerated cell was 21.5% and in the anaerobic cells, 11.5%. The four parts of this report detail the activity during the last year of the project and summarize the data collected for the span of the project (1/1/64 to 12/31/68).
W71-06103

COMMUNITY FACILITIES PLAN; WATER AND SEWER PLAN; PUBLIC IMPROVEMENTS PROGRAM AND CAPITAL BUDGET, ECHERD, TENNESSEE.
Echard Municipal Planning Commission, Tenn.
For primary bibliographic entry see Field 06B.
W71-06105

SANITARY CONTROL OF SHELLFISH IN AREA,
Environment Control Administration, Cincinnati, Ohio. Water Supply and Sea Resources Program.
For primary bibliographic entry see Field 02L.
W71-06110

PROBLEMS OF POLLUTION OF IRRIGATION WATERS IN ARID REGIONS,
Utah State Univ., Logan, Dept. of Agricultural and Irrigation Engineering; and Robert S. Kerr Water Research Center, Ada, Okla.
H. B. Peterson, A. A. Bishop, and J. P. Law, Jr.
In: Water Quality Management Problems in Arid Regions, Federal Water Quality Administration Water Pollution Control Research Series 13030 DYY 6/69, p 17-36, October 1970. 20 p, 3 fig, 4 tab, 27 ref.

Descriptors: *Irrigation water, *Water pollution sources, *Irrigation, *Arid climates, Surface waters, Groundwater, Irrigation effects, Agriculture, Agricultural chemicals, Saline water, Wastes, Evaporation, Water pollution sources, Water conservation, Sediments, Soil-water-plant relationships, Nutrients, Irrigation practices.

The climate in arid regions is conductive to high evapotranspiration losses and a minimum of natural leaching. For intensive crop production, irrigation is necessary. Irrigated soils of the United States are scattered throughout, but the major areas are in the 17 western states. Within these, the areas most adversely affected by salt in the irrigation return flow are those in the lower reaches of the larger river systems of southwestern United States; those areas in the Lower Basin of the Colorado River, the Gila and Salt Rivers of Arizona, the Rio Grande in New Mexico and Texas, the San Joaquin River in California, and similar streams. In all of these river basins, there is a progressive deterioration in water quality as it flows downstream. Different pollutants have very diverse and changing effects on the value of water. Salts generally decrease the value more or less in proportion to the concentration increase; however, there are broad critical ranges where the user is forced to change the type of crop, and then there may be a sharper value decline for a given increment of salt. This can continue until at some concentration the water can no longer be used for irrigation and must be disposed of or treated. (See also W71-06111) (Woodard-USGS)
W71-06112

NATURAL POLLUTION IN ARID LAND WATERS,
Utah State Univ., Logan. Ecology Center.
John M. Neuhold.
In: Water Quality Management Problems in Arid Regions, Federal Water Quality Administration Water Pollution Control Research Series, 13030 DYY 6/69, p 79-84, October 1970. 6 p, 2 ref.

Descriptors: *Water pollution, *Arid lands, *Surface waters, *Water pollution sources, Streams, Streamflow, Geology, Vegetation, Evaporation, Topography, Runoff, Precipitation (Atmospheric), Sediment transport, Water quality, Turbidity, Dissolved solids, Geochemistry, Evaluation.
Identifiers: *Natural water pollution.

This report explores the meaning of natural pollution in an arid lands surface-water system, generalizes a definition for this pollution and speculates on the possible consequences of the pollution thus defined. During periods of precipitation, the surface flow is usually loaded with relatively high concentrations of particulate matter which increases the corrosive quality of the water, and its turbidity. High evaporative losses result in a concentration of solids dissolved from the geological formations making up the watershed and the silt loads carried by the runoff. Most definitions agree that pollution implies a change in quality as a result of man's use. Similarly, the term natural can be variously defined. It can include or exclude the influence of man. Two approaches to natural pollution considering man are that first, man is considered part of an ecosystem which he can manipulate but only to the limit of available resources or to levels of limiting factors before collapse of the system results. What affects the system affects him. In the second approach, man sets himself apart from the system. He manipulates it to maximize his immediate economic gain. In the first, and ecological ethic of land and water use is inherent. In the second, it is nonexistent. (See also W71-06111) (Woodard-USGS)
W71-06113

ANIMAL WASTE RUNOFF--A MAJOR WATER QUALITY CHALLENGE,
Federal Water Quality Administration, Kansas City, Mo. Missouri Basin Region.
Anthony V. Resnik, and John M. Rademacher.
In: Water Quality Management Problems in Arid Regions, Federal Water Quality Administration Water Pollution Control Research Series 13030 DYY 6/69, p 95-105, October 1970. 11 p, 25 ref.

Descriptors: *Water pollution sources, *Livestock, *Wastes, *Surface waters, *Groundwater, Cattle, Hogs, Sheep, Seepage, Runoff, Streams, Lakes, Streamflow, Organic wastes, Biochemical oxygen demand, Water quality, Nitrates, Abatement, Planning, Water pollution control.
Identifiers: *Feedlots.

Animal wastes contaminate water supplies, destroy fish and aquatic life in streams, and generally degrade water quality. More important, it is also known that animal wastes are a controllable major source of water pollution necessitating immediate attention. Since feedlots have generally been located without regard to the soil inventory and topographic characteristics, surface runoff to streams with subsequent damage from high BOD wastes is common. Infiltration of nitrates from manures to well waters is documented. Sixty-six thousand feedlots, ranging in capacity up to 100,000 animals blanket 7 to the 10 Missouri Basin States. Animal wastes from the more than 20 million cattle, 16 million swine and 7 million sheep defecate wastes equivalent to 370 million people. The human population of the Missouri Basin Region is 7.9 million. Assuming that 5% of the animal waste enters the streams, the calculated stream pollution from animal wastes in the basin is more than twice the human population equivalent. The extent of the problem as well as the effects on surface and groundwaters are illustrated with research data. The present status of legislation in regulatory control of pollution is discussed. Measures to strengthen present regulations are proposed. (See also W71-06111) (Woodard-USGS)
W71-06114

NITRATE POLLUTION OF WATER,
Illinois State Water Survey, Urbana.
Julius H. Dawes, Thurston E. Larson, and Robert H. Harmeson.
In: Frontiers In Conservation, Proceedings 24th Annual Meeting Soil Conservation Society of America, August 10-13, 1969, Colorado State University, Fort Collins, p 94-102, 1970. 9 p, 8 fig, 6 tab, 6 ref.

Descriptors: *Water pollution sources, *Groundwater, *Surface waters, *Nitrogen compounds, Illinois, Hydrologic cycle, Fertilizers, Industrial wastes, Decomposing organic matter, Organic wastes, Domestic wastes, Livestock, Precipitation (Atmospheric), Water quality, Chemical analysis, Soils, Soil water, Seepage, Sorption, Crops, Nitrates.

Nitrogen levels in surface waters that exceed established standards are evidence of mans intrusion in the environment and the cause of deterioration in water quality. Thirty-nine million tons of chemical fertilizers were applied in the United States in 1967, of which approximately 6 million tons was nitrogen. In Illinois about 25% of all water samples from wells 50 feet deep or less have been found to contain an excessive concentration of nitrate, that is, above the 45 milligrams per liter level. The sources of nitrogen in Illinois surface and subsurface waters are varied and often difficult to identify. Known sources of pollution include precipitation, human wastes, crop residues, decomposing animal or plant tissue, industrial wastes, and nitrogen fertilizer. At the present time there is no

known practical and economical way of recovering these excess nitrates. Membrane techniques and biological methods both have potential for preventing pollution of water by nutrients, salts, and minerals, whether the source is fertilizer, irrigation water, sewage, or industrial wastes. (See also W71-06129) (Woodard-USGS)
W71-06130

WATER QUALITY AT THE DADE-COLLIER TRAINING AND TRANSITION AIRPORT, MIAMI INTERNATIONAL AIRPORT, AND COTTONMOUTH CAMP-EVERGLADES NATIONAL PARK, FLORIDA, NOVEMBER, 1969,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05A.
W71-06158

THE MONOCACY RIVER-PHYSICAL, CHEMICAL AND BACTERIOLOGICAL WATER QUALITY REPORT NUMBER 1, MARCH-DECEMBER 1966,
Maryland Dept. of Water Resources, Baltimore. Div. of Water Quality Investigations.
Charles R. De Rose.
Maryland Division of Water Quality Investigations Report, December 1967. 108 p, 16 fig, 11 tab, 20 ref, 2 append.

Descriptors: *Water pollution sources, *Rivers, *Water quality, *Maryland, *Data collections, Domestic wastes, Industrial wastes, Land use, Chemical analysis, Streamflow, Discharge measurement, Runoff, Sampling, Coliforms, Dissolved oxygen, Biochemical oxygen demand, Water temperature, Methodology, Nitrates, Phosphates, Color, Dissolved solids.
Identifiers: *Monocacy River basin (Md).

During 1966, water quality of the Monocacy River was determined from 21 stations located in the 58-mile section of the Maryland portion of the river from the mouth to the Pennsylvania State line. Sixteen major tributaries were included with stations located near the mouths of the streams. Additional stations were located on 6 streams to study the effect of sewage treatment plant discharges. Water quality was studied and compared with criteria for dissolved oxygen, biochemical oxygen demand (B.O.D.), pH, and coliform bacteria. Wide variations in stream flow occurred frequently and affected the water quality. The water quality in the middle section of the Monocacy River, which included a 22-mile section of river above the Frederick City sewage treatment plant discharge, was generally good. Minimum dissolved oxygen concentrations remained at about 5.0 ppm. Of the 16 major tributaries studied, Carroll Creek was found to be severely polluted and a large contributor to the pollution load borne by the Monocacy River. (Woodard-USGS)
W71-06176

MONTHLY VARIATION IN PHOSPHATE AND RELATED CHEMICALS FOUND IN THE SEDIMENT IN THE ISLAND AREA OF LAKE ERIE, 1967-68, WITH REFERENCE TO SAMPLES COLLECTED IN 1964, 1965, and 1966,
Ohio State Univ., Columbus. Water Resources Center
N. Wilson Britt, and Edwin J. Skoch.
Available from NTIS as PB-198 128, $3.00 in paper copy, $0.95 in microfiche. Ohio Water Resources Center Project Completion Report No 333X, 1970. 30 p, 3 tab, 6 fig, 33 ref. OWRR Project A-008-OHIO (2).

Descriptors: *Lake Erie, *Phosphorous, *Iron, *Eutrophication, Great Lakes, Mud-water interfaces, Dissolved oxygen, Water pollution sources.
Identifiers: *Bottom sampling, *Sediment analysis, Substrate, Organic carbon, Oxygen consumed.

Samples of sediment collected in 1964, 1965, 1966, and on a monthly basis from May 1967 through November 1968, were analyzed for total phosphate, iron and organic carbon. Samples were collected by means of a core technique developed by E. J. Skoch. The cores were sectioned at 2.5 cm intervals and each of the six sections was analyzed for the same factor. Results of the analyses showed only a slight increase in phosphate since 1964. However, all those factors showed a definite increase from May 1967 through November 1968. The two sampling methods yielded slightly different results. The sediment was found to consist of two distinct layers, with the upper 5 cm of sediment being usually higher in concentrations of materials than the lower portion.
W71-06187

REMARKS ON THE DRIFT OF OILY WASTE IN THE BAY OF HELGOLAND (IN GERMAN),
Deutsches Hydrographisches Institut, Hamburg (West Germany).
Heinrich Neumann.
German, English and French abstracts. Deutsche Hydrographische Zeitschrift, Vol 22, No 2, 1969. 6 ref.

Descriptors: *Oil, *Sludge, *Drifting, Ships, Damages, Water pollution sources.
Identifiers: *TMS Maria Xilas, German Bight.

The discharge of oil, surface drift, and oil sludge settling, after damages to the ship, TMS 'Maria Xilas', were studied. The role of offshore factors in the drift process is discussed. The drift of oil lumps beneath the surface and effects of seaway and surges which can eventually carry the lumps from sea bottom to surface and on to shore are investigated. (Ensign-PAI)
W71-06206

POLLUTION OF AMERICAN COASTS BY OIL (IN GERMAN),
R. Adam.
Wasser, Luft und Betrieb, International, Vol 14, No 7, July 1970, p 289.

Descriptors: *Water pollution control, *Oil wastes, *Seepage, Accidents, Coasts.
Identifiers: North America, England.

The increase of coastal pollution from oil spills, seepage and underwater oil drilling accidents is considered. Reference is made to the Santa Barbara oil spill and the grounding of a tanker off the coast of England. (Ensign-PAI)
W71-06208

POLLUTION, BY BIOSYNTHESIS 'IN SITU' OF CARCINOGENOUS HYDROCARBONS, OF A LAGOON BIOCENOSIS 'IN VITRO' REPRODUCTION OF THIS PHENOMENON (IN FRENCH),
Centre de Recherches du Service de Sante des Armees, Paris (France). Division de Biologie Generale et Ecologie.
P. Niaussat.
French and English Summaries. Revue Internationale D'Oceanographie Medicale, Vol 17, p 87-98, 1970. 4 tab, 20 ref.

Descriptors: *Oil, *Anaerobic bacteria, *Phytoplankton, Water pollution sources.
Identifiers: Biosynthesis, Biocenosis, Benxo-3-4-Pyrene.

A hydro-biological investigation of marine biocenosis in the isolated lagoon of Clipperton indicated that in a natural environment with an absence of industrial pollution biosynthesis of some carcinogenous hydrocarbons, particularly benzo-3-4-pyrene, is possible. This hypothesis was confirmed by experimentation. In mixed cultures of marine phytoplankton and bacteria, growing rate of benzo-3-4-pyrene was demonstrated in terms of time culture. The interruption of bacterial growth by utilization of antibiotics stabilizes the increase of this hydrocarbon's rate. (Ensign-PAI)
W71-06209

AERIAL PHOTOGRAPHIC TRACING OF PULP MILL EFFLUENT IN MARINE WATERS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
Fred J. Burgess, and Wesley P. James.
Copy available from GPO Sup Doc as I67.13/4: 12040EBY 08/70, $1.25; microfiche from NTIS as PB-198 232, $0.95. EPA-WQO Report 12040 EBY August 1970. 152 p, 11 tab, 68 fig, 20 ref, 6 append. EPA-WQO Grant WP-00524.

Descriptors: *Pulp and paper industry, *Waste water disposal, *Remote sensing, *Aerial photography, Industrial waste, Sewage effluents, Oceans, Coasts, Outlets, Mixing, Diffusion, Currents (Water), Bioassay, Temperature, Water pollution sources, Path of pollutant.

Aerial photography taken of waste plumes from Kraft pulp mill ocean outfalls was shown to be an effective tool in the study of waste disposal sites. This technique is not limited by sea conditions and permits monitoring and evaluation of outfall sites throughout the year. Photography taken at one instant provides comprehensive information throughtout the waste field. Manpower requirements and costs for this method are considerably less than for conventional boat sampling surveys. Field studies were conducted on the waste plumes from Kraft pulp mill ocean outfalls at Newport and Gardiner, Oregon and Samoa, California. Waste concentrations were measured by conventional boat sampling techniques while aerial photography was taken of the outfall area from altitudes ranging from 3,000 to 11,000 ft. Computerized procedures were used to compute water currents, waste concentrations, toxicity zones and diffusion coefficients from the photography. The highest concentration measured directly over the outfalls was 2.3 percent waste by volume and the maximum area of influence with concentrations greater than 0.2 percent waste was 155 acres. The maximum concentration determined over the outfall for each field study was generally less than that shown to have a detrimental effect on young salmon for a 14-day exposure. Surface water current was found to be the dominant factor in the resulting plume pattern. During periods of low current velocities in the receiving water, the hydraulic head created by the effluent source was a significant factor in the resulting plume shape. The steady state form of the Fickian diffusion equation and unidirectional transport velocity was not applicable to the majority of the observations. (Burgess-Oregon State)
W71-06258

LIQUID WASTE EFFLUENTS FROM A NUCLEAR FUEL REPROCESSING PLANT,
Northeastern Radiological Health Lab., Winchester, Mass.
P. Magno, T. Reavey, and J. Apidianakis.
Available from NTIS as PB-196 442, $3.00 in paper copy, $0.95 in microfiche. Technical Report BRH/NERHL 70-2, November 1970. 59 p, 19 fig, 27 tab, 9 ref.
Identifiers: *Radioactive contaminants, *Water pollution, *Nuclear fuel reprocessing, Water pollution, Concentration (Composition), Tritium, Ruthenium isotopes, Strontium 90, Cesium 137, Cesium 134, Purex process, Radioactive isotopes, Stream pollution, New York, Sampling, Dilution, Mixing, Sediments, Ruthenium 106, *Water pollution detection, Cattaraugus County (New York).

The liquid waste effluents from a commercial nuclear fuel reprocessing plant were studied in detail during a six-month period May through October 1969. The concentrations and amounts of individual radionuclides discharged from the plant were measured and the amounts of sedimentation of individual radionuclides in the lagoon system were estimated. Tritium, ruthenium-106, strontium-90, cesium-137 and cesium-134 were the principal radionuclides discharged to the environment during this period. No relationship could be established between the amount and burnup of fuel processed and the amount of activity discharged from the plant to the lagoon system during this study. For the Yankee fuel campaign of May-August

1969, the waste management practice and not the amount of fuel processed was the controlling factor in the amount of activity discharged from the plant to the lagoon system. Simultaneous sampling was carried out at the point of discharge of the waste and several locations on the Buttermilk and Cattaraugus Creeks. Tritium, ruthenium-106, and strontium-90 were the radionuclides present in the highest concentrations in these streams during these periods. Stream dilution and absorption factors were calculated for individual radionuclides at various locations along the stream system.
W71-06269

ABSTRACT OF PROCEEDINGS, HAZARDOUS POLLUTING SUBSTANCES SYMPOSIUM: ANNEX 1 TO STUDY ON CONTROL OF HAZARDOUS POLLUTING SUBSTANCES, SEPT. 14-16, 1970. NEW ORLEANS, LA.
Coast Guard, Washington, D.C.

Available from NTIS as PB-195 342, $3.00 in paper copy, $0.95 in microfiche. September 1970. 561 p.

Identifiers: *Water pollution, *Hazardous materials, *Water transportation, Water pollution, *Industrial wastes, Water pollution, Water quality, Meetings, Definitions, Government policies, Law jurisprudence, Economic analysis, Detection, Stream pollution, Oceans, Insurance, *Water pollution, Oceans, Insurance, *Water pollution detection, Water pollution damage.

A symposium was held with its principal objective being the solicitation of the views of industry, academic leaders, conservationists, state governments, and other non-federal government spokesmen on the identification and response to the uncontrolled release of hazardous polluting substances into the navigable waters of the United States. The symposium employed a panel format encompassing three areas: (1) definition and classification; (2) prevention, detection and removal; and (3) legal and economic factors. The report contains an abstract of the comments made by some 400 interested parties, along with the recommendations made by each panel.
W71-06270

A GENERAL REVIEW OF CONTINUOUS WATER QUALITY ANALYSIS INSTRUMENTATION,
Robert H. Jones.
Beckman Instruments, Inc. Process Instruments Division, Fullerton, Calif. 15 p.

Descriptors: *Instrumentation, *Monitoring, Water quality.
Identifiers: *Water quality monitor.

Beckman Instruments, Inc. offers a multi-parameter Water Quality Monitor for continuous measurement of: disolved oxygen, temperature, pH, chloride ion, turbidity, oxidation-reduction potential, sunlight radiation intensity and conductivity. The new instrument features sensors which improve reliability of continuous monitoring while reducing maintenance requirements. This instrument is compatible with conventional forms of transmission and data handling. Pollutants in water such as silt, slimes, soluble and suspended solids, and algae coat and contaminate sensing elements. This paper explains Beckman's approach to this problem of continuous water quality monitoring.
W71-06295

CITY OF HARRISONVILLE V W S DICKEY CLAY MFG CO (ENJOINING CITY'S SEWAGE DISPOSAL INTO STREAM AS TEMPORARY NUISANCE).
For primary bibliographic entry see Field 06E.
W71-06304

INTRODUCTION: ISSUES IN FOOD PRODUCTION AND CLEAN WATER,
Agricultural Research Service, Beltsville, Md. Water Conservation Research Div.
For primary bibliographic entry see Field 05G.
W71-06429

POLLUTION BY SEDIMENT: SOURCES AND THE DETACHMENT AND TRANSPORT PROCESSES,
Iowa State Univ., Ames. Dept. of Agricultural Engineering; and Agricultural Research Service, Beltsville, Md. Water Conservation Research Div.
H. P. Johnson, and W. C. Moldenhauer.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 1, p 3-20. 2 tab, 2 fig, 59 ref.

Descriptors: *Water pollution, *Sediments, *Sediment transport, Bed load, Suspended load, Soil erosion, Gully erosion, Sheet erosion, Rill erosion, Sediment yield, Watersheds, Iowa, Losses, Regression analysis, Specific weight, Streams, Yield equations.
Identifiers: *Detachment, *Erosion equation, Universal Soil Loss Equation, Correlation coefficient, Sediment delivery ratio, Reservoir sedimentation.

The paper attempts to identify problems in the sediment pollution area, define the present understanding of the erosion and transport process, and to indicate research needs. Gross erosion from land, including both sheet and gully erosion, is discussed, and empirical methods of quantitative measurement are presented as well as research approaches. Primary sources of sediment yield information are reservoir sedimentation surveys and suspended load samplings. Finally a look is taken at sediment in transport and its two components suspended load and bed load. The science of erosion and sediment transport needs to advance considerably if it is to be sufficiently flexible for use in detailed planning. (See also W71-05437) (White-Iowa State)
W71-06430

CHEMISTRY OF SEDIMENT IN WATER,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div; and Minnesota Agricultural Experiment Station, St. Paul.
R. F. Holt, R. H. Dowdy, and D. R. Timmons.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 2, p 21-34. 2 fig, 1 tab, 49 ref.

Descriptors: *Sediments, *Nitrogen, *Phosphorus, Chemistry, Water pollution, Clays, Mineralogy, Montmorillonite, Illite, Colloids, Clay minerals, Organic matter, Ions, Ion exchange, Cation exchange, Anion adsorption, Oxidation-reduction potential, Nitrification, Denitrification.
Identifiers: Preferential removal, Electrical charge, Surface area, Reduced layer, Surface oxidized layer.

Sediment can be considered a major pollutant of surface waters. However, its contribution to the dissolved chemicals in lakes and streams is largely unknown. The composition of sediment closely resembles the soil from which it is derived but is generally higher in silt, clay, and organic matter. Chemical reactions involving sediment are essentially the surface chemistry of their colloidal fractions which is a function of their surface area and electrical charge. As a result, reactions with sediment can be divided into interactions with charged ions and with neutral compounds. The chemistry of sediments in situ can be surmised from studies of submerged soils. Sediments carry relatively large amounts of total nitrogen and phosphorus into surface waters, but in both cases only a small proportion of this total is readily available to the biosystem. Sediments apparently have a high capacity to remove phosphate from solution, but without turbulence the release of phosphate from bottom sediments will not support algal growth at appreciable distances from the sediment. Available inorganic nutrients, particularly phosphorus, are rapidly taken up by the biosystem in natural waters. They eventually become a part of the organic fraction of the sediment and their release back to the waters is not well resolved. (See also W71-05437) (White-Iowa State)
W71-06431

SIGNIFICANCE OF PHOSPHORUS IN WATER SUPPLIES,
Southern Illinois Univ., Carbondale. Dept. of Botany.
Jacob Verduin.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 5, p 63-71. 1 fig, 4 tab, 12 ref.

Descriptors: *Phosphorus, *Nutrients, Water pollution, Fertilizers, Oxygen, Nitrogen, Sewage, Effluents, Phosphates, Carbon dioxide, Odor, Taste, Eutrophication, Water sheds, Tennessee Valley Authority Project, Detergents, Farm wastes, Lagoons.
Identifiers: *Plant nutrients, N/P ratio, Enrichment.

The author gives data showing the marked increase in total phosphorus concentrations in our streams and lakes. Although there has been a large increase in agricultural fertilizer use, evidence suggests that approximately one-third of the phosphorus contributions may come from agricultural watersheds. In urban sewage effluents, detergents seem to contribute about three times more phosphate than is contributed by the organic matter in sewage. Consequently, detergents would appear to be the most significant single source of phosphates enriching our waters today. The author contends that animal and domestic wastes belong on the land as fertilizer and soil improvers rather than discharging nutrient rich lagoon and sewage plant effluents directly to streams. As such, agriculture has a primary role to play in the solution of the pollution problem. In the problem of removing concentrated nutrients from water, agricultural technology can make a major contribution in the application of the living root zone filter to the process of plant nutrient removal. (See also W71-05437) (White-Iowa State)
W71-06433

BEHAVIOR OF SOIL AND FERTILIZER PHOSPHORUS IN RELATION TO WATER POLLUTION,
Iowa State Univ., Ames. Dept. of Agronomy.
C. A. Black.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 6, p 72-93. 10 fig, 1 tab, 57 ref.

Descriptors: *Phosphorus, *Soils, Water pollution, Phosphates, Fertilizers, Solubility, Organophosphorus compounds, Groundwater, Surface waters, Aqueous solutions, Saturation, Distribution, Adsorption.
Identifiers: *Orthophosphate, Plant residues, Concentrations, Biological cycle, Phosphorite, Langmuir equation, Reaction capacity.

The principal objective of this chapter is to present an account of selected aspects of the behavior of soil and fertilizer phosphorus as a basis for understanding how phosphorus from these sources may contribute to the phosphorus content of waters in the soil and leaving the soil. Chemical and geologic phosphorus cycles in the soil are traced. The reactions and distribution of fertilizer phosphorus in soil are described. The distribution of both inorganic and organic phosphorus is pointed out. (See also W71-05437) (White-Iowa State)
W71-06434

SOURCES OF NITROGEN IN WATER SUPPLIES,
Geological Survey, Denver, Colo.
Marvin C. Goldberg.

Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 7, p 94-124. 4 fig, 8 tab, 72 ref.

Descriptors: *Nitrogen, *Nitrates, Groundwater, Ammonia, Precipitation, Sediments, Denitrification, Runoff, Ureas, Fertilizers, Drainage water, Irrigation, Return flow, Water supply, Livestock, Sewage, Infiltration, Industrial wastes, Algae, Ponds, Farm wastes.
Identifiers: *Surface waters, Geological sources, Mineralization, Nitrogen sources, Well water, Feedlots.

Water supplies can be categorized as surface waters or groundwaters. This paper examines representative studies of nitrate entrance to both types of water supplies, with summaries of some of the many laboratory and field studies described in the current literature. Some of the sources of nitrogen entrance to water supplies include atmospheric, geologic, rural and urban runoff, sewage, irrigation, animal wastes, and industrial wastes among many others. Sources of major importance to both surface and groundwater supplies are pointed out and field or laboratory studies are reported. (See also W71-05437) (White-Iowa State)
W71-06435

CHEMISTRY OF NITROGEN IN SOILS,
Illinois Univ., Urbana. Dept. of Agronomy; and Missouri Univ., Columbia. Dept. of Agronomy.
F. J. Stevenson, and G. H. Wagner.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 8, p 125-141. 8 fig, 26 ref.

Descriptors: *Nitrogen, *Nitrates, *Ammonium compounds, Fertilizers, Inorganic compounds, Nitrites, Microorganisms, Climates, Nitrification, Denitrification, Leaching, Organic matter, Amino acids, Lignins, Chemistry, Soils.
Identifiers: *Fixation, Mineralization, Immobilization, Volatilization, Amines, Pyrimidine.

This review emphasizes the complex nature of soil nitrogen. Other than gaseous forms, the inorganic N consists primarily as NH4 (..) and NO3 (-). Part of the NH4 (..) is bound to colloidal surfaces and behaves according to classical reactions of exchange chemistry. Nitrate is free to move with the soil water and is the form of N which is of greatest concern from the standpoint of pollution of water supplies. Many soils contain appreciable amounts of NH4 (..) that cannot be utilized directly by plants and microorganisms; this NH4 (..) is held within the lattice structures of clay minerals. Less than one-half of the organic N in soils can be accounted for in known compounds (amino acids, amino sugars, purine and pyrimidine bases, etc.). The remainder may occur as part of the structures of humic and fulvic acids. Part of the N added to soils as fertilizers can be converted to organic forms by chemical reactions involving NH3 (..) and NO2 (-); this combined N is only slowly mineralized and may persist in soil for prolonged periods. Bacterial denitrification is an important factor regulating NO3 (-) levels in natural soil and may serve as a means of reducing the NO3 (-) content of groundwater when land is used for the disposal of nitrogenous wastes. (See also W71-05437) (White-Iowa State)
W71-06436

FERTILIZER MANAGEMENT FOR POLLUTION CONTROL,
Minnesota Univ., St. Paul. Dept. of Soil Science.
For primary bibliographic entry see Field 05G.
W71-06437

THE PESTICIDE BURDEN IN WATER AND ITS SIGNIFICANCE,
Federal Water Pollution Control Administration, Athens, Ga. Southeast Water Lab.
H. Page Nicholson.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 12, p 183-193. 3 tab, 32 ref.

Descriptors: *Pesticides, *DDT, Toxicity, Dieldrin, Chlorinated hydrocarbon pesticides, Aldrin, Endrin, Heptachlor, Runoff, Water pollution, Industrial wastes, Insecticides.
Identifiers: *Environmental contamination, Concentrations, Sources, Parathion, Pesticide pollution.

Sources of pesticide polluted water include runoff, industrial wastes, accidents and carelessness. Graphic examples of each are given to gain perspective about the potential for pesticide involvement in water pollution. The significance of chlorinated hydrocarbon pesticides with respect to water pollution is shown. Concentrations in some lakes and streams has increased. A final section on control of pesticide pollution gives ideas and methods which should result in less water pollution by pesticides. (See also W71-05437) (White-Iowa State)
W71-06439

HERBICIDE RESIDUES IN AGRICULTURAL WATER FROM CONTROL OF AQUATIC AND BANK WEEDS,
Agricultural Research Service, Denver, Colo. Crop Research Div; and Agricultural Research Service, Laramie, Wyo. Crops Research Div.
F. L. Timmons, P. A. Frank, and R. J. Demint.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 13, p 194-208. 4 tab, 31 ref.

Descriptors: *Herbicides, *2-4-D, *Aquatic weed control, Dalapon, 2-4-5-T, Alligator weed, Copper sulfate, Ponds, Pond weeds, Reservoirs, Irrigation canals, Sprinkler irrigation, Furrow irrigation, Drainage, Water hyacinth, Runoff.
Identifiers: *Herbicide dissipation, Drainage ditches, Submersed weeds, Amitrole, Silvex.

The effectiveness of herbicides and the economics involved in agricultural production have caused their extensive use for weed control in and adjacent to aquatic areas, especially on irrigation systems. Greater use of herbicides in and around agricultural waters may be expected. Maximum residues of herbicides used for weed control in farm ponds and reservoirs are low, ranging from a fraction of 1 ppm to several ppm. In most cases these levels are of short duration. The transport of herbicide residues in irrigation water prevents extensive exposure of any given irrigated area. The flowing water may at times carry residues to areas where their presence may be objectionable. While reduction in residue level varies with canal and herbicide, many residues are dissipated after a water flow of 10 to 15 miles. In most cases, the dissipation can be attributed to dilution in water or absorption by bottom mud. The concentrations of herbicides found in irrigation water are unlikely to cause injury in crops. Where residues were found in crops following irrigation with water containing herbicides, the levels were generally much lower than tolerances already established for the same or similar crops. (See also W71-05437) (White-Iowa State)
W71-06440

PESTICIDES AND PEST MANAGEMENT FOR MAXIMUM PRODUCTION AND MINIMUM POLLUTION,
Iowa State Univ., Ames. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 05G.
W71-06441

EFFECTS OF SURFACE RUNOFF ON THE FEASIBILITY OF MUNICIPAL ADVANCED WASTE TREATMENT,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-06445

NITROGEN AND AMINO ACIDS IN THE FECES OF YOUNG PIGS RECEIVING A PROTEIN-FREE DIET AND DIETS CONTAINING GRADED LEVELS OF SOYBEAN OIL MEAL OR CASEIN,
Guelph Univ. (Ontario). Dept. of Nutrition.
Kathleen H. Carlson, and H. S. Bayley.
Journal of Nutrition, Vol 100, No 11, p 1353-1361, 1970. 5 tab, 3 fig, 17 ref.

Descriptors: *Nitrogen, *Amino acids, *Proteins, *Diets, Farm wastes, Hogs, Water pollution sources.
Identifiers: Young pigs, Protein-free diets, Casein, Soybean oil meal.

Thirty-two piglets were weaned at 14 days of age and received a nutritionally complete diet; at 20 days of age they were allocated to either a protein-free diet, or diets containing 7, 14, or 21% protein from either soybean oil meal or casein. Feed consumed between 21 and 31 days of age was measured and the feces voided were collected. The n-butyl-N-trifluoroacetyl esters of the amino acids in hydrolysates of feed and feces were separated by gas-liquid chromatography. The amounts of fecal nitrogen and of each of the 13 amino acids of metabolic origin were calculated directly from the observations made on the protein-free diet and indirectly by regression analyses of the outputs of the piglets receiving the diets containing graded levels of protein. The metabolic fecal nitrogen excretion determined directly (111 mg. N.100 g. feed consumed) agreed more closely with other published values than the indirect estimates obtained by regressions. The direct values were used in calculating the corrected digestibilities of the nitrogen and of the amino acids in the two protein sources. The corrected digestibilities of the nitrogen and amino acids in the casein were very high (97 - 100%), but were lower for the soybean meal. There were significant differences in the corrected digestibilities of the individual amino acids in the soybean oil meal, which ranged from 82% for alanine to 93% for glutamic acid. The level of inclusion of casein did not influence the corrected digestibilities of the amino acids, but increasing the level of soybean oil meal in the diet caused a significant reduction in the corrected digestibilities of isoleucine, leucine and proline. (Christenbury-Iowa State)
W71-06451

5C. Effects of Pollution

MERCURY USES IN CANADA AND THEIR POSSIBLE HAZARDS AS SOURCES OF MERCURY CONTAMINATION,
University of Western Ontario, London. Dept. of Zoology.
For primary bibliographic entry see Field 05B.
W71-05861

THE ECOLOGY AND OCEANOGRAPHY OF SEWER OUTFALLS,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 06G.
W71-05928

EFFECT OF FEEDLOT LAGOON WATER ON SOME PHYSICAL AND CHEMICAL PROPERTIES OF SOILS,
Kansas State Univ., Manhattan. Dept. of Agronomy, and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
David O. Travis, W. L. Powers, L. S. Murphy, and R. I. Lipper.
Partially supported by OWRR, Dept. of Interior.
Soil Science Society of America Proceedings. Vol 35, No 1, p 122-126, January-February 1971. 5 p, 1 fig, 4 tab, 12 ref. OWRR Project A-016-KAN (2).

Descriptors: *Farm wastes, *Water pollution effects, *Path of pollutants, *Irrigation water, *Waste water disposal, Lagoons, Saline soils,

itrates, Salts, Leaching, Soil water, Soil chemis-
y, Soil properties, Soil texture, Soil structure.
lentifiers: Feedlot lagoons.

agoon water from cattle feedlot runoff was added
undisturbed soil columns 42 cm long and 6.7 cm
diameter. The infiltration rate of the lagoon
ater into the columns was measured and
corded. After each run, the soil columns were
ctioned into 3-cm increments and analyzed for
a, Mg, Na, K, and NH4 ions. Also the electrical
nductivity of a saturation extract from the top 15
n of each column was determined. Water flow in
e soil columns stopped for all soils before two
re volumes of filtrate could be collected. The
rcentages of Na, K, and NH4 ions increased in
e surface increments of the soil columns. The
ctrical conductivity of the saturation extracts for
soils was increased by more than 200% by ad-
ng the lagoon water to the soil. The saturation ex-
ct of the treated soils had electrical conductivity
lues of between 2.80 and 5.05 mmhos/cm. (K-
pp-USGS)
71-05974

**FECTS ON PH ON THE LIFE CYCLE OF
IE MIDGE TANYTARSUS DISSIMILIS,**
deral Water Quality Administration, Duluth,
nn. National Water Quality Lab.
nry L. Bell.
nadian Entomologist, Vol 102, No 5, p 636-639,
70. 2 tab, 10 ref. FWQA Program 18050 WAI
/70.

scriptors: *Toxicity, *Hydrogen ion concentra-
n, *Midge, *Bioassay, Life history studies,
thal limits, Water limits, Water pollution effects,
ife cycles.
ntifiers: *Ph toxicity.

stages of the life cycle of the midge Tanytarsus
ratanytarsus) dissimilis Joh. were subjected to
pH and the extremes of tolerance were deter-
ned. The life cycle could not be completed
ow a pH of 5.5
1-05982

**FECTS OF OIL POLLUTION ON WATER-
WL A STUDY OF SALVAGE METHODS,**
ological Society of San Diege, Calif. Health
pt.
n A. Griner, and Robert Herdman.
by available from GPO, SOD, No
.13/4:15080EBZ 12/70, $0.50. Also available
n NTIS as PB-198 091, microfiche $0.95.
ter Pollution Control Research Series
80EBZ 12/70, December, 1970. 35 p, 2 tab, 13
8 ref. EPA-WQO Program 15808 EBZ 12/70.

scriptors: Water pollution effects, Oil, *Oil
tes, *Oil water California, *Waterfowl, *Mal-
duck, *Geese (Wild), *Ducks (Wild).
ntifiers: Santa Barbara (Calif), Grebes, Loons,
s, Murres.

udy was made of salvage methods for waterfowl
ected to oil pollution. Mallard ducks were the
nary test species used. Aspects of the pathology
ome of the waterfowl species involved in the
ta Barbara oil slicks were also investigated.
ough some refined petroleum products contain
c compounds, the Santa Barbara crude used as
st oil in this study produced no apparent ill ef-
s. Polycomplex A-11 was found to be a rapid
effective cleansing agent for the removal of oil
bird plumage. Oil on bird plumage alters
her structures by replacing the small air
kets between barbules of the feather, thereby
easing buoyancy and insulation. Removal of oil
down feathers is more difficult than from the
our feathers. Ducks and geese are amendable
eatment and post-treatment care than are the
e aquatic fowls, such as grebes, loons, auks and
res. Confinement times should be as brief as
ible, as the incidence of mycotic and other in-
ous diseases increases under long periods of
e confinement.
-05983

PLANKTON DIATOM ASSEMBLAGES IN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoermer, and J. J. Yang.
Copy available from GPO, SOD, No I67.13/4:18050DKC. 12/69, $2.00. Also available from NTIS as PB-198 087, microfiche $0.95. Water Pollution Control Research Series 1805ODKC, 12/69, Dec 1969. 268 p, 65 ref, append. FWQA Program 18050 DKC.

Descriptors: *Plankton, *Diatoms, *Lake Michigan, Sampling, Population, Water pollution effects, Plants.
Identifiers: Diversity estimates.

The various elements of Lake Michigan plankton diatom flora, their seasonal cycles, and history of changes were determined and genera and species are listed. Absolute frequency, relative frequency, and contribution to diversity of each taxon were computerized. Occurrence of the different entities were recorded: those associated with certain water quality conditions; constitutents of only extremely oliogotrophic floras, rapidly replaced in disturbed portions of the lake; those more tolerant of changing conditions but rapidly reduced in abundance with extensive chemically measurable changes; other entities seemingly favored by slight increases in trophic level, flourishing in moderately disturbed portions of the lake, but declining when pollution increases; those formerly able to thrive only in naturally eutrophic estuaries and inshore areas, favored by increasing pollution and now flourishing in highly disturbed open lake areas; the final general group of dominant plankton species including those taxa, apparently not able to live in the original conditions of Lake Michigan but introduced following pollution. All of the plankton diatoms associated with extreme water quality degradation in the Great Lakes system are now present in Lake Michigan, indicating critical pollution levels. (Jones-Wisconsin)
W71-05984

REPORT ON BIOLOGICAL, CHEMICAL, AND GEOLOGICAL STUDIES OF BOIS BRULE AND POPLAR RIVER WATERSHEDS,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Albert Dickas, Donald Bahnick, Donald Davidson, Joseph Horton, and Ronald Roubal.
Wisconsin Univ, Madison, Water Resources Center, 1970. 5 p. OWRR Project A-023-WIS (8).

Descriptors: *Rivers, *Eutrophication, *Forests, Streams, Erosion, Clays, Hydrogen ion concentration, Watersheds (Basins), Sedimentation.
Identifiers: *Deforestation, Specific conductance, Bois Brule River (Wis), Popular River (Wis).

A comparison of the eutrophication status of two rivers in northern Wisconsin revealed a pronounced negative influence of deforestation. The Bois Brule River with its forest surroundings is much less subjected to runoff than the Popular River located in a deforested watershed. The effect of forest cover is conspicuously reflected in dynamics of two chemical characteristics of water: only small fluctuation of pH value during rainy and rain-free periods, and a decrease rather than an increase in specific conductance on pluvial days. The reverse was observed on the Poplar River whose watershed includes highly erodible lacustrine clay. (Wilde-Wisconsin)
W71-05986

EUTROPHICATION STUDIES OF A SHALLOW INLET ON VANCOUVER ISLAND,
Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station.
For primary bibliographic entry see Field 02L.
W71-05988

TOXICITY OF ZINC, COPPER AND LEAD TO CHLOROPHYTA FROM FLOWING WATERS,
Durham Univ. (England). Dept. of Botany.
B. A. Whitton.
Archiv fur Mikrobiologie, Vol 72, p 353-360, 1970. 1 tab, 7 ref.

Descriptors: *Indicators, *Algae, *Heavy metals, *Toxicity, Copper, Chlorophyta, Water pollution, Nutrients, Rivers, Lakes, Farm ponds.
Identifiers: *Zinc, *Lead, Stigeoclonium tenue, Cladophora glomerata, Ulotrichales, Zygnemales, Oedogonium, Mougotia, Sporotetras pyriformis, Gongrosira, Microspora, Spirogyra, Ulothrix.

The biological and economic interest of heavy metals in the relation to freshwater algae led to a survey of toxicity of zinc, copper, and lead to Chlorophyta in flowing waters. Twenty populations each of Stigeoclonium tenue and Cladophora glomerata were tested for variations in metal resistance. The only indication found was a slight increase in resistance to zinc of one Stigeoclonium population from a metal-polluted stream. Thirty-five other algal populations, representing about 25 species, were also tested. Comparison of these populations showed that in the test medium used Cladophora glomerata was the most or almost the most sensitive to all three metals. It was absent from streams known to be polluted by lead or lead and zinc. The Ulotrichales and most of the Zygnemales were relatively resistant to zinc, while all the Oedogonium species taken from the field were sensitive to zinc. However, an Oedogonium population highly zinc resistant was obtained from a zinc enriched laboratory tank. Because the medium used in the present experiments is relatively rich in nutrients such as phosphates it may well mask effects that would show in a less favorable environment. (Jones-Wisconsin)
W71-05991

MUSSELS (UNIONIDAE) OF THE RED RIVER VALLEY IN NORTH DAKOTA AND MINNESOTA, USA,
North Dakota Univ., Grand Forks. Dept. of Geology.
Alan M. Cvancara.
Malacologia, Vol 10, No 1, p 57-92, 1970. 9 fig, 4 tab, 44 ref. OWRR Project A-007-NDAK (1).

Descriptors: *Mussels, *Water pollution effects, North Dakota, Minnesota, Tributaries, River systems, Chlorides, Turbidity, Stagnant water.
Identifiers: *Red River (ND), Unionidae, Lampsilis siliquoidea, Lasmigona complanata, Anodonta grandis, Anodontoides ferussacianus.

This paper lists 13 species of mussels inhabiting the northern part of the Red River and 18 species in its tributaries in eastern North Dakota and western Minnesota. The most common species are: Lasmigona complanata, Anodonta grandis, Anondontoides ferussacianus, and Lamsilis siliquoidea. Although the Red River is a part of the Mississippi system, its fauna constitutes only 1/4th of the main stream. The restricted distribution of mussels is attributed to the prolonged lack of river flow, high content of chlorides, water pollution, and high turbidity. (Wilde-Wisconsin)
W71-06001

INFLUENCE OF INDUSTRIAL EFFLUENTS ON ARTHROPODS OF THE MARINE SUPRALITTORAL ZONE, (IN GERMAN),
Erlangen-Nuremberg Univ. (West Germany). Zoologisches Institut.
Hermann Remmert.
English summary. Oecologia (Berl), Vol 5, p 158-164, 1970. 3 tab, 10 ref.

Descriptors: *Sea water, *Marine animals, *Oil, *Water pollution effects, Industrial wastes, Mortality, Toxicity, Insects.
Identifiers: *Arthropods, *Oil pollution, Burning oil, Crude oil.

Both investigated organisms, the fly Limosina brachystoma, and the amphipod Orchestia platensis, can survive for several weeks in foliage moistened with 1.5% solution of sodium chloride.

Yet, pollutants of burning oil in contact with water are fatal to these organisms even in very low concentrations. The air, however, is freed from the toxic ingredients within one week. Crude oil which floated in the sea for a prolonged period also is not poisonous to the arthropods or their larvae. On the other hand, the organisms, especially Orchestia, have a very low resistance against sulfuric acid. (Wilde-Wisconsin)
W71-06003

EUTROPHICATION: CAUSE--EFFECT RELATIONSHIPS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Earl E. Shannon, and Patrick L. Brezonik.
Dep of Environmental Engineering, Florida University, Gainesville (Undated). 59 p, 4 fig, 13 tab, 30 ref. OWRR Project B-004-FLA (3).

Descriptors: *Lakes, *Trophic level, *Florida, Eutrophication, Watersheds, Analysis, Color, Indicators, Primary productivity, Chlorophyll, Nitrogen, Phosphorus, Transparency, Conductivity, Regression analysis.
Identifiers: Trophic state indices.

This study was concerned with the relationship between the trophic state of 55 Florida lakes and their watershed characteristics. On the basis of cluster analysis, the lakes were grouped into 24 colored and 31 relatively clear lakes. All of the lakes were further subdivided into trophic groups delineated by values of 7 trophic state indicators: primary production, chlorophyll a, total organic nitrogen, total phosphorus, disc transparency, conductance, and sodium .. potassium:calcium .. magnesium ratio. Multiple regression analyses revealed a significant relationship between values of trophic state indices (TSI) and characteristics of watersheds including land use, extent of fertilizer treatments, and density of population. Canonical analyses of trophic variables and eutrophication-causing factors gave similar results. (Wilde-Wisconsin)
W71-06009

REACTION RATES OF PHOTOSYNTHESIS,
Green Engineering Affiliates, Somerville, Mass.
M. M. Varma, and R. S. Talbot.
Proceedings Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, July 1965, p 146-174. 20 fig, 5 tab, 33 ref.

Descriptors: *Light intensity, *Photosynthesis, *Chlamydomonas, Aquatic environment, Aquatic microorganisms, *Hydrogen ion concentration, *Temperature, Water pollution effects.
Identifiers: Buffer.

Investigations were made to study the effect of changing intensity of light, pH, temperature, and age culture on the rate of photosynthesis of Chlamydomonas. Observations of the rate of photosynthesis were made with a sodium bicarbonate-carbonate buffer and a potassium bicarbonate-carbonate buffer. Studies were also made to establish a correlation between the weight and number per unit volume of Chlamydomonas organisms using the gravimetric method and the membrane filter technique. The rate of photosynthesis increased with temperature at a given initial pH and light intensity. Under given conditions, there is optimum light intensity at which the rate of photosynthesis is a maximum and the intensity of light is more critical at 25C than at 30C. It was also found that essentially a straight line relationship exists between weight and number per volume of Chlamydomonas. (Ellis-Texas)
W71-06039

DEGRADATION OF WATER QUALITY IN IRRIGATION RETURN FLOWS,
Robert S. Kerr Water Research Center, Ada, Okla.; and Oklahoma State Univ., Stillwater Dept. of Agronomy.
For primary bibliographic entry see Field 03F
W71-06063

INTRODUCTION, PROCEEDINGS OF 2ND THERMAL WORKSHOP OF UNITED STATES INTERNATIONAL BIOLOGICAL PROGRAM,
Maryland Univ., College Park.
J. A. Mihursky, and J. B. Pearce.
Chesapeake Science, Vol 10, No 3, p 125-127, Sept-Dec, 1969.

Descriptors: *Thermal pollution, Temperature, Environmental engineering, Heat, Thermal powerplants, Aquatic plants, Aquatic life, Water pollution.
Identifiers: Temperature effects.

Highlights of the second Thermal Workshop held at the Chesapeake Biological Laboratory of the University of Maryland, Nov. 3-7, 1968, are outlined. The conference theme centered on the effects of temperature and temperature change on the aquatic environment. It was stated that aquatic inhabitants have specific and seasonal temperature requirements that must not be exceeded. Constructive use of waste heat has sound theoretical foundations. Temperature alterations resulting from man's activities have caused changes in distribution and abundance in plant and animal population. Temperature alterations were recognized as only one of many instances of accelerated environmental modification due to man's activities. (Novotny - Vanderbilt)
W71-06075

BIOLOGICAL REACTIONS AND PATHOLOGICAL CHANGES OF HUMAN BEINGS AND ANIMALS UNDER THE CONDITION OF ORGANIC MERCURY CONTAMINATION,
Kumamoto Univ. (Japan). Medical School.
Tadao Takeuchi.
Presented at International Conference on Environmental Mercury Contamination, Ann Arbor, Michigan, 1970. 30 p, 76 ref, 16 fig, 11 tab.

Descriptors: *Heavy metals, Water pollution effects, Human pathology, Diseases, Epidemiology, Toxicity, Water quality, Water pollution, Air pollution, Chemical wastes, Industrial wastes.
Identifiers: Mercury pollution, Mercury effects, Mercury contamination.

Organic mercury contamination results from (1) some mercury residue produced in chemical plants; (2) fungicides used widely in farms, (3) erratic use of disinfectants and fungicides for medical supplies and clothes and, (4) other unknown factors. Factors (1) and (2) are connected with the dumping of mercury into the water from the chemical industry. On the basis of investigations on Minamata disease brought about by organic mercury contamination, the biological reactions and pathological changes were discussed. The clinical symptoms of the disease are cerebellar atoxia, constriction of visual fields, and dysarthria. Other symptoms are those resulting from the lesion of the cerebral cortex and peripheral nerves, particularly sensory peripheral nerves of extremeties. It was found that alkylmercury, particularly methylmercury compounds may contaminate environmental subjects with the effluent from the plants and they are absorbed by organisms, accumulated in some organs and tissues, and give rise directly and indirectly to various disturbances of human beings and animals. (Novotny-Vanderbilt)
W71-06076

THE ABSORPTION OF MERCURY FROM FOOD, ITS SIGNIFICANCE AND NEW METHODS OF REMOVING MERCURY FROM THE BODY,
Rochester Univ., N.Y.
T. W. Clarkson, and R. E. Shapiro.
Presented at Symposium on 'Mercury and Man's Environment', February 15 and 16, 1971, Royal Society of Canada, Ottawa. Typescript, 9 p, 2 tab, 3 fig.

Descriptors: *Heavy metals, *Toxicity, *Food Fish, Metals, Water pollution, Water pollution effects, Food chains, Human pathology, Wastes, Environmental engineering.
Identifiers: Mercury, Mercury pollution.

According to studies in Sweden and the USA, the mercury present in fish muscle is in the form methyl mercury compounds. The form of mercu in non-aquatic food products is, as yet, general undefined. The experimental results of the kineti of the mercury metabolism in experimental anima (mice) is presented. Three stages of mercury co tamination can be distinguished: (1) state of i creased mercury level, (2) steady state, when i take of mercury from food is exactly balanced excretion, and (3) after removing the animals fro exposure to mercury, the amount in the bo declines. The problem of mercury in food is methyl mercury problem. A new means of remo ing methyl mercury from the body could trapping mercury in the intestines so as to preve reabsorption. Polystyrene resins were used for th purpose. Mice fed food with 1% resin excrete mercury 3 times faster than control mice, and, aft 22 days, had only 20% of the mercury level in bra tissue as the controls did. (Novotny-Vanderbilt)
W71-06080

EMBRYOTOXICITY OF MERCURY COM POUNDS,
Food and Drug Directorate, Ottawa (Ontario Div. of Toxicology.
David J. Clegg.
Presented at Symposium on 'Mercury and Man Environment', February 15 and 16, 1971, Roy Society of Canada, Ottawa. Typescript, 9 p.

Descriptors: *Heavy metals, *Human patholog *Toxicity, Pathology, Animal pathology, Disease Environmental effects, Epidemiology, Water pollu tion, Nutrient requirements, Food chains.
Identifiers: *Mercury, Metals effects, Mercury po lution, Mercury effects.

The information currently available regarding th embryotoxic activity of the alkyl mercurial com pounds is reviewed. These compounds appear to b the mercury compounds of most crucial concern t man. In the case of the alkyl mercurial compounds the embriotic effects apparently result from direc toxic action of the parent compound on the foetu or embryo, and possibly also by damaging th gametes prior to fertilization. Alkyl mercurials ca exert embryotoxic, or teratogenic activity i laboratory animals. Human data available fro Japan are also discussed and these confirm the im plications from laboratory animal studies. Th minimum dose level tested (mg/kg-day) ha resulted in indications of embryotoxic activity in a least one experiment. The present temporary ac ceptable daily intake, according to Swedish esti mate, of 0.0004 mg/kg-day is based upon huma blood levels in cases of minimal signs of huma mercury intoxication. This figure may have to b reduced as further information becomes available (Novotny-Vanderbilt)
W71-06081

THE EFFECTS OF THERMAL DISCHARGES ON THE STRATIFICATION CYCLE OF LAKES
Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
T. R. Sundaram, and R. G. Rehm.
AIAA 9th Aerospace Sciences Meeting, New York, AIAA Paper No 71-16, January 25-27, 1971 11 p, 4 fig, 1 tab, 22 ref.

Descriptors: *Stratification, *Lakes, *Powerplants Epilimnion, *Thermal pollution, Thermocline Temperature, Mathematical models.
Identifiers: Thermal discharges.

The effects of power-plant thermal discharges on the seasonal stratification cycle of temperate lakes are considered. A theoretical model, which includes the interaction between wind-induced tur bulence in the lake and the buoyancy gradients due

to surface heating as well as the thermal discharges, is developed and solved numerically for some typical cases. It is shown that the thermal discharges increase the temperature during spring homothermy, and the stratification period. The increases in temperatures due to thermal discharges, are greater at deeper levels than at the surface. Under certain conditions, thermal discharges may lead to a reduction in the epilimnetic volume. This article contains 22 references. (Upadhyaya-Vanderbilt)
W71-06082

THE EFFECT OF VARYING AND CONSTANT TEMPERATURES ON THE SIZE OF A MARINE COPEPOD,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
Anthony R. Lock, and Ian A. McLaren.
Limnology and Oceanography, Vol 15, No 4, p 638-640, July 1970. 2 tab, 10 ref.

Descriptors: *Thermal pollution, Temperature, Foods, Light, Size.
Identifiers: Marine copepods.

One-hundred stage three copepodites of Pseudocalanus Minutus were reared to maturity in the laboratory in an excess of food at about 5, 8, and 12C. Mean length of adult females was inversely related to temperature, but that of adult males was unaffected. Mean length of females reared in a light-temperature regime of alternately 12 hr. at 8C in weak light and 12 hr. at 12C in darkness did not differ significantly from estimated mean length at a constant, intermediate temperature of 10C. These experiments suggest that vertical migration in thermally stratified waters will not enhance length of this species. (Upadhyaya-Vanderbilt)
W71-06083

THE MIXING OF A SHALLOW SUBMERGED HEATED WATER JET WITH AN AMBIENT RESERVOIR,
Maryland Univ., College Park. Dept. of Mechanical Engineering.
Atul M. Mahajan, and James E. A. John.
AIAA 9th Aerospace Sciences Meeting, New York, AIAA Paper No 71-17, p 12, January 25-27, 1971. 12 fig, 1 tab, 3 ref.

Descriptors: *Thermal pollution, *Temperature, Heated water, Dimensional analysis, Velocity, Heat transfer, Mixing.
Identifiers: *Shallow submerged jet, Two-dimensional, Prandtl number.

The work reported here is an attempt to provide information on the discharge of submerged turbulent two-dimensional hot water jet near the surface of a reservoir. Experimental tests were made in a tank 8 ft. long and 6 inches wide and 4 ft. deep, with jet velocity 8 fps and jet temperature 0C, 50C and 60C above the tank temperature. Velocities were measured with a hot film probe, temperatures with copper constantan thermocouples. Empirical dimensionless correlations were obtained which yielded the path of the point of maximum velocity in the jet as it moved towards the surface. Below the point of maximum velocity, velocity and temperature distributions were similar to those of a deeply submerged jet. Above this point, temperatures were considerably higher than those of a deeply submerged jet. The buoyancy, in the case of a heated water jet has negligible effect on the flow pattern of a shallow submerged jet, but has significant effects on the flow patterns of a deeply submerged jet. (Upadhyaya-Vanderbilt)
W71-06084

VERTICAL DIFFUSIVITY COEFFICIENT IN A THERMOCLINE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
For primary bibliographic entry see Field 02H.
W71-06088

THERMAL POLLUTION, AQUACULTURE AND PATHOBIOLOGY IN AQUATIC SYSTEMS,
Maryland Dept. of Research and Education, Solomons. Chesapeake Biological Lab.
J. A. Mihursky, A. J. McErlean, and V. S. Kennedy.
Journal of Wildlife Diseases, Vol 6, p 347-355, October 1970. 6 fig, 31 ref. OWRR Project A-002-MD (8).

Descriptors: *Thermal pollution, *Temperature, *Aquatic life, *Pathology, Aquatic environment, Animal pathology, Plant pathology, Biology, Thermal powerplants, Fish, Aquatic bacteria, Environmental engineering.
Identifiers: Temperature effects.

The effect of higher than normal temperatures on aquatic life are discussed. Thermal-biotic predictive models that describe two categories of temperature relationships to estuarine fauna have been developed. The expected present temperature increase due to steam electric stations is about 5-15C. The temperature increase, besides the possible lethal influence on aquatic organisms, may also result in sub-optimal physiological conditions from the standpoint of pathology, which means that this state presents an opportunity for pathogenic organisms to overcome their host species. A number of operational factors from steam electric stations other than temperature are responsible for detrimental effects on aquatic organisms (chlorine, heavy metals, mechanical effects). A closed recycle and reuse waste water system to produce useful foodstuff is proposed and discussed. (Novotny-Vanderbilt)
W71-06092

TEMPERATURE CONTROL IN OUTDOOR EXPERIMENTAL PONDS,
Minnesota Univ., Minneapolis.
H. Stefan, E. Silberman, P. Vaidyaraman, and W. Geiger.
St. Anthony Falls Hydraulic Laboratory, Proj Rep No 116, Dec 10, 1970. 16 p. FWQA Program 18050 euj.

Descriptors. *Temperature control, *Ponds, *Heat transfer, Cooling, Heating, Model studies, Research facilities, Evaporation, Conduction, Radiation, Temperature, Environmental engineering, Air temperature, Water temperature, Heat balance, Heat exchangers, Thermal pollution.
Identifiers: Experimental models.

A system of outdoor experimental ponds for the study of aquatic life under the effect of various controlled water temperatures has been designed. The ponds were to be located near power plants in Minnesota. The purpose of the study is to determine the feasibility of maintaining certain specified temperature regimes in the proposed ponds. This was done by considering the available heating and cooling capacity and the environmental conditions prevailing at the selected site and making design calculations for the major elements of the system. Firstly, the limits of feasible temperature control were determined. Secondly, heating and cooling systems were devised and thirdly, a method of control was developed. For cooling, use of the well water is proposed, and, for heating, the water released from the thermal power station is going to be used. External and internal heat exchange systems were examined and both were found to be feasible and adequate. The study has the character of a feasibility study. (Novotny-Vanderbilt)
W71-06093

THERMAL CRITERIA - A MEASURE TO CONTROL THERMAL POLLUTION,
New York State Dept. of Health, Albany.
Satyendra P. Mathur, and Donald B. Stevens.
Presented January 1970 at Cooling Tower Institute in New Orleans. Transcript. 10 p.

Descriptors: *Temperature standards, *Thermal pollution, Thermal power plants, Temperature, Temperature effects, Cooling, Streams.

The major source of thermal pollution is cooling water released from different industries, i.e. steam electric plants, shell mills, etc. The effect of thermal discharges on the receiving waters can be divided into three broad categories: physical, chemical, and biological. The New York State approach to controlling discharges of heated waters is discussed. As a thermal discharge a waste (cooling) water with temperature greater than 70 deg F is understood. Thermal criteria are adopted for fresh and tidal waters. The criteria for all categories (non-trout waters, trout waters and lakes; coastal waters and estuaries) are discussed. (Novotny-Vanderbilt)
W71-06096

POWER PLANTS: EFFECTS OF CHLORINATION ON ESTUARINE PRIMARY PRODUCTION,
Maryland Dept. of Research and Education, Solomons. Cheasapeake Biological Lab.
D. H. Hamilton, Jr., D. A. Flemer, Carolyn W. Keefe, and J. A. Mihursky.
Science, Vol 169, p 197-198, July, 1970.

Descriptors: *Thermal powerplants, *Chlorination, *Aquatic microorganisms, Water pollution, Water quality, Primary productivity, Estuaries, Photosynthesis, Temperature, Thermal pollution.
Identifiers: Effects of chlorination.

Steam electric stations may reduce primary production of cooling water by 91 percent as a result of chlorine applications for control of fouling organisms. Bacterial densities and concentrations of chlorophyll are also reduced. Slight stimulation of production may occur in the absence of chlorination. Based on the available supply of 'new' water a maximum loss of primary production of 6.6 percent for the adjacent tidal segment of the Patuxent River was calculated. The results of experiments designed to examine the effect of plant operation on primary productivity are presented. (Novotny-Vanderbilt)
W71-06097

ALGAECIDAL EVALUATION AND ENVIRONMENTAL STUDY OF MAT PRODUCING BLUEGREEN ALGAE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 04A.
W71-06102

SOME ASPECTS OF BIOLOGY OF CARCINUS MAENAS (L) II SURVIVAL AT LOW SALINITY,
University of Strathclyde, Glasgow (Scotland). Dept. of Biology.
E. J. Perkins, E. Gribbon, and R. B. Murray.
The Transactions of the Dumfriesshire and Galloway Natural History and Antiquarian Society, 3rd ser vol 46, p 27-28, 1969. 4 ref.

Descriptors: *Salinity, *Crabs, Salt tolerance, Predation, Lethal limit.
Identifiers: Aspects, Carcinus maenas, Green shore crab.

The green shore crab, Carinus maenas, is an important predator of animals dwelling in inshore waters. In the laboratory, crabs were subjected to a range of salinity from 1.0 to 8.4%, with the mean temperature 8.4 deg. Salinities slightly less than 2% were rapidly lethal. Between 2 - 3% survival was dramatically improved for 1-34 days. Size was important in survival up to 6%, but of 5% large and small animals survived equally well. (Wahtola-Washington)
W71-06179

TEMPERATURE SELECTION AND HEAT RESISTANCE OF THE MOSQUITO FISH, Gambusia affinis,
Arkansas Univ., Fayetteville.
Edmond j. Bacon, Jr., William H. Neill, Jr., and Raj V. Kilambi.

Proc of the 21st Annual Conference of the Southeastern Association of Game and Fish Commissioners, p 411-416, 1967. 3 fig, 5 ref. OWRR Project A-007-ARK (3).

Descriptors: *Temperature, *Heat resistance, *Fish, Thermodine, Sexual maturity, Fish physiology, Warm water fish.
Identifiers: Gambusia affinis, Thermal distribution, Mosquito fish.

The temperature selection and heat resistance of the mosquito fish is described. The average selected temperature of a sample of Gambusia affinis previously acclimated to 20 deg C decreased from 28-29 deg C to about 27 deg C after the fish had lived in a temperature gradient tank for one month. The final thermal distribution of the fish varied with sex and developmental stage. Males selected lower temperatures than did adult females. The young fish, although more scattered than the adults, occurred mostly at temperatures higher than those selected by the adults. These results may indicate temperture separation of young and adult fish in nature which would reduce intraspecific predation and competition. Heat resistance of adult females taken from the 26.2 deg C-compartment of the temperature-gradient tank was higher than the resistance of 28.0 deg C acclimated fish. The temperature-gradient females either had attained a high acclimation level by temporarily venturing above 28.0 deg C or had accumulated high resistance by living at varying temperatures below 28.0 deg C. (Wahtola-Washington)
W71-06180

THE EFFECTS OF THE HERBICIDES DIQUAT AND DICHLOBENIL (CASORON) ON POND INVERTEBRATES PART I. ACUTE TOXICITY,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Dennis C. Wilson, and Carl E. Bond.
Transactions of the American Fisheries Society 98: p 438-443, 1969. 7 tab, 15 ref.

Descriptors: *Herbicides, *Toxicity, *Bioassay, *Invertebrates, *Aquatic insects, Dragonflies, Mayflies, Caddisflies, *Amphipoda, Lethal limit, *Diquat, Water pollution effects, 2-6-Dichlobenil.
Identifiers: *TL50, Casoron, IC50, Damselflies, Baetidae, Lunnephilidae, Coenagrionidae, Libellulidae.

The acute toxicity was determined for the herbicide Diquat and Dichlobenil. The median tolerance limits (TLm) of Diquat (1:1-ethylene-2:2'-dipyridylium dibromide) and Dichlobenil (2,6-dichlorobenzonitrile) to one amphipod and larvae of five species of aquatic insects were determined. Diquat was over 300 times more toxic to the amphipod (Hyalella azeteca) than to the mayfly (Callibaetis sp.) while the caddisfly (Limnephilus sp.), tendipedid (Tendipedidae), damselfly (Enallagma sp.), and dragonfly (Libellula sp.) in that order, were more resistant. The addition of pond mud to the test vessels changed the 96-hour TLm of Diquat for the amphipod from 0.046 to 6.8 mg/liter. Dichlobenil was less toxi than Diquat to the amphipod but more toxic to the aquatic insects. Dichlobenil had a narcotizing effect that was recorded as an immobilization concentration (IC50). The addition of pond mud did not reduce the toxicity of Dichlobenil to the caddisfly. The 4% granular formulation of Dichlobenil had a 72-hour 'lag' before an effective concentration was obtained equivalent to the toxic effect of the 50% wettable powder. Dichlobenil formed a strong layer at the bottom of the test vessel and was more toxic with time to the invertebrates than to the fishes Micropterus salmoides and Lepomis marochirus. (Wahtola-Washington)
W71-06181

DISSOLVED OXYGEN CRITERIA FOR THE PROTECTION OF FISH,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Peter Doudoroff, and Dean L. Shumway
American Fisheries Society Special Publication No. 4, p 13-19, 1967. 3 fig, 16 ref.

Descriptors: *Dissolved oxygen, Fish physiology, Fisheries, Growth rates, Embryonic growth stage, Energy budget, Juvenile growth stage, Standards, Water quality, *Freshwater fish.

The rates of growth and embryonic development and the activity of fish can be limited by the supply of oxygen even when dissolved oxygen concentrations are near or above air-saturation levels. Oxygen concentrations well below 3 mg/liter can be tolerated for long periods by the fish and fish embryos. Fishery biologists should decline to specify any particular dissolved oxygen level as a minimal requirement of any fish population or as a proper standard of water quality unitl the necessary clear guidelines or explicit definitions of terms are provided by pollution-control agencies desiring such simple criteria. The dissolved oxygen level at which growth of fish is limited by the oxygen supply depends on the amount of food available, as well as other environmental factors such as temperature. No reduction of dissolved oxygen below natural levels probably is the only 'standard' that would afford complete protection for fishery resources under all circumstances, but adoption of this standard for the regulation of waste disposal usually would be unrealistic and unnecessary. Any lower or less restrictive standards applicable over wide ranges of temperature probably should be expressed as oxygen conentrations (mg/liter) rather than as percentages of saturation. They should be designed to prevent, by limiting diurnal or other fluctuations of dissolved oxygen, frequent exposure of fish to nonlethal but very low dissolved oxygen levels even for periods of moderate duration. The choice of suitable criteria or standards probably should be based in part on bioenergetic considerations relating to fish growth and production rates, but it is not simply and entirely a biological problem. (Wahtola-Washington)
W71-06182

EFFECTS OF ALKYL BENZENE SULFONATE ON BREEDING BEHAVIOR OF FLAGFISHES, Jordanella floridae,
Academy of Natural Sciences of Philadelphia, Pa.
Neal R. Foster, and John Cairns, Jr.
The ASB Bulletin, Vol 13, No 2, April 1966. 34 p. NIH Grant EF-00266.

Descriptors: *Water pollution effects, Bioassays, Detergents, Breeding, Killifishes, Alkylbenzene sulfonates, Fish behavior, Toxicity.
Identifiers: Jordanella floridae, Flagfish.

The Florida flagfish, Jordanella floridae Goode and Bean, is well suited for bioassays involving effects of toxicants in breeding behavior. Under optimum conditions, these killifishes spawn virtually daily in laboratory aquaria. Male flagfishes occupy specific bottom territories and defend these. A female can enter a male's territory and solicit spawning by undergoing a color change and 'backing' towards him in a distinctive fashion. After spawning, the male fans the substrate where the eggs were laid. Under test conditions, flagfish exhibit normal breeding behavior for at least four days' exposure to an introduced concentration of 6 p.p.m alkyl benzene sulfonate mixture (54.8% active ingredients). Significantly less breeding behavior was observed, and no viable eggs were recovered, in concentrations of 11.5 p.p.m. and 24 p.p.m ABS mixture. (Wahtola-Washington)
W71-06184

'KEROSENE' TAINT IN SEA MULLET (Mugil cephalus Linnaeus),
Department of Primary Industries, Brisbane (Australia).
E. M. Grant.
Fisheries Notes, Department of Harbours and Marine, Vol 3, No 1, 1969. 13 p, 1 tab, 6 ref.

Descriptors: *Mullets, Water pollution effect *Taste, Fisheries, *Fish diets, Oil wastes, Oi water, Odor.
Identifiers: *Mugil cephalus, Kerosene taint, Au tralia.

Sampling showed that fishermen were leaving larg schools of sea mullet in the belief that they we 'kerosene'-tainted, the actual level of tainting w quite low (0.28 per cent). Also, the level of taint a sessed at this time by fishermen greatly exceede that derived from a consumer panel. Consumptio of 'kerosene'-tainted sea mullet produces a mo unpleasant kerosene-like after-taste, but no oth effects were noted. Although 'kerosene'-tainted se mullet are abundant in the vicinity of Lugga Point (Brisbane R.), only about one-half of the se mullet of the area are so affected. 'Kerosene tainted sea mullet also occur in Noosa R., a rel tively unpolluted stream 75 sea miles north of th Brisbane R. It is extremely improbable that a fected fish had migrated from the Brisbane R. the Noosa R. 'Kerosene'-tainted sea mullet fro Luggage Point were active and apparently health They had been feeding heavily on a dark-gr sludge which had a metallic smell and a faintly a tringent taste. Even some small fish (9-inch) we strongly 'kerosene'-tainted. (Wahtola-Washingto W71-06185

ALGICIDES,
Wisconsin Univ., Madison. Water Resourc Center.
George P. Fitzgerald.
Available from NTIS as PB-198 130, $3.00 paper copy, $0.95 in microfiche. Wisconsin Uni Madison, Water Resources Center, Eutrophicatio Information Program, Literature Review No 1971. 50 p, 1 fig, 9 tab, 153 ref. OWRR Project W 117No 1614) (3).

Descriptors: *Algicides, *Algae, *Algal contro Testing, Laboratory tests, Chemicals, Bacteri cides, Cultures, Test procedures, Pesticide toxicit Resistance, Lakes, Reservoirs, Swimming pool Chelation, Application methods, Cooling tower Water pollution effects.
Identifiers: Detoxification, Synergism, Fish pond Algistatic activity, Algicidal activity.

An evaluation of algicides--what they are, the usage, how they are tested, their efficiency, a methods of application--is presented. Detailed a appropriate test organisms, culture and test medi the importance of algicidal versus algestatic effect and effective chemical concentrations required achieve potential toxicity. Characteristics of a algal problem, together with its environment, i fluence the methodology of application process as well as detoxification, resistance, and synergis Algal problems of water supply reservoirs a recreational lakes, fish ponds, swimming pools, a cooling towers are specifically discussed with su gestions for effective application of toxicants f their control. (Auen-Wisconsin)
W71-06189

SELECTIVE WITHDRAWAL AT LAK LIVINGSTON, PRELIMINARY EVALUATION 1969,
Texas Univ., Austin. Center for Research in Wat Resources.
E. G. Fruh.
Available from NTIS as PB-198 131, $3.00 paper copy, $0.95 in microfiche. Center f Research in Water Resources Report, No 5 Progress Report No 1, June 1970. 102 p, 29 tab, 1 fig, 19 ref, 7 append. OWRR Project B-040-TE (1).

Descriptors: *Computer programs, Model studie Nutrients, Microbiology, Bioassay, Water analysi Texas, Water pollution effects, Water pollutio control.
Identifiers: *Selective withdrawal, *Lake Livin ston, Kohn-Debler, Bohan-Grace, Trinity River.

A literature survey was conducted to evaluate the significance of selective withdrawal models available. Field investigations were made at several lakes and Lake Livingston to substantiate these models and to determine the changes in water quality of the Trinity River as Lake Livingston fiils. The Koh-Debler and Bohan-Grace models were used to compare data from the literature with observed results from Lake Travis. The various inputs of data and the effect of varying these inputs upon the predicted water outlet temperature were investigated. It is concluded that a broader range of test must be run before either model can be applied with confidence to Southwestern U.S. impoundments. During the tests for water quality at Lake Livingston it was found that a high influx of oxygen demanding substances and nutrients enter the reservoir via the Trinity River. Turnover of water in the reservoir also affected water quality. Selective withdrawal did not appear to be feasible for water depths less than 40 feet but the data indicated the selective withdrawal programs at greater depths will be successful. (Ellis-Texas)
W71-06193

THE LIFE OF MICROBES IN THE SEA AND THE CURRENT POLLUTION OUTLOOK (IN FRENCH),
Poitiers Univ. (France). Faculte de Medicine et de Pharmacie.
Jean Brison.
English summary. Revue Internationale D'Oceanographie Medicale, Vol 17, p 127-244, 1970. 15 ref.

Descriptors: *Seashores, *Water pollution abatement, *Water pollution control, Outlets, Bacteria, Self-purification, Public health.
Identifiers: *Population explosion.

Pollution of the seashore by bacteria, virus and parasites is well established. The increase of population and the demographic growth have been found to follow a parallel curve. The phenomena or natural self-purification is no longer possible with the volume of pollution in today's environment. The consequences and long term effects of this constant contamination are not yet fully determined. The author feels it should be recognized that the situation has become alarming and cooperation from everyone is needed. Accent should be placed first on prevention and then on control. (Ensign-PAI)
W71-06202

ANTIBACTERIAL SUBSTANCES PRODUCED BY MARINE BACTERIA (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Gauthier.
English and French Summaries. Revue Internationale D'Oceanographie Medicale, Vol 17, p 23-45, 1970. 3 tab, 5 graph, 22 ref.

Descriptors: *Marine bacteria, *Pseudomonas, *Biodegradation, *Self-purification, Water pollution effects.
Identifiers: Antibacterial substances, Lipo-Polysaccharides, Chromobacterium.

The antibiotic products synthesized by some marine bacteria were studied bacteriologically and biochemically. The activity of several strains of chromobacterium and the lipo-polysaccharides discharged in the culture media are investigated. Self purification or the endogenous microbial antagonism of these products is discussed. (Ensign-PAI)
W71-06203

STUDY OF THE INFLUENCE OF BDELLORIBRIO BACTERIOROUS IN MARINE SELF-PURIFICATION (IN FRENCH),
S. Daniel.
French and English Summaries. Revue Internationale d'Oceanographie Medicale, Vol 15, No 16, p 61-102, 1969. 17 fig, 12 tab, 35 ref.

Descriptors: *Microorganisms, *Bacteria, *Parasitism, *Self-purification, Water pollution effects.
Identifiers: Bdellovibrio bacteriovorus.

Action of the microorganisms and bacterial parasites in the phenomena of marine purification is evaluated. Bdellovibrio bacteriovorus are located in rivers and polluted areas near the seashore. Their presence in the marine environment is associated with the bacterial pollutants that they parasitize and they are sensitive to the antibacterial properties in seawater. (Ensign-PAI)
W71-06204

POSSIBILITY OF STUDYING THE EFFECTS OF POLLUTION ON BENTHIC ORGANISMS EMPLOYING IMMERSED PANELS (IN FRENCH),
Centro di Studio sulla Corrosione Marina dei Metalli, Genoa (Italy).
G. Relini, Oliva Dabini, and L. Ferretti.
English summary. Revue Internationale D'Oceanographie Medicale, Vol 17, p 189-199, 1970. 2 tab, 2 fig, 20 ref.

Descriptors: *Water pollution, *Pollutants, *Benthos, *Fouling, Water pollution effects.
Identifiers: *Asbestos panel method, Genoa Harbour.

Hydrological and biological investigations were conducted in several areas of Genoa harbour subjected to different types of pollution. Relationships between fouling organisms and pollution were studied with asbestos panels immerged at the various experimental stations. (Ensign-PAI)
W71-06205

THE OCCURRENCE OF POLYCYCLIC AROMATIC CARBOHYDRATES IN COASTAL WATERS AND ITS POSSIBLE EFFECTS ON MAN'S HEALTH (IN GERMAN),
M. J. Suess.
English, French, German and Spanish Summaries. Archiv fuer Hygiene und Bakteriologie, Vol 154, No 1, p 1-7, June 1970, Italy, October 2, 1969. 4 tab, 46 ref.

Descriptors: *Oil wastes, *Distribution, *Aquatic life, Water pollution effects, Public health.
Identifiers: *Carcinogenic polyciclic aromatic hydrocarbons.

Carcinogenic polyciclic aromatic hydrocarbons (PAH) are distributed widely throughout the world and are found in coastal waters near heavily populated areas as well as remote unpopulated sites. Endogenic synthesis of flora appears to be a major contributor. Concentrations of PAH in estuaries and coastal waters may be increased by industrial and municipal wastes and atmospheric precipitation. The concentration of carcinogenic PAH in marine fauna used for human consumption was pointed out. However, no definite evidence exists that wastes polluting our seafood is an actual cancer threat to the general public. These possibilities, it is suggested, should not be overlooked in order to prevent possible complication in the future. (Ensign-PAI)
W71-06207

ANTIBACTERIAL ACTIVITY OF A MARINE DIATOM ASTERIONELLA NOTATA (GRUN) (IN FRENCH),
M. Gauthier.
English and French Summaries. Revue Internationale d'Oceanographic Medicale, Vol 15, No 16, p 103-171, 1969. 17 fig, 23 tab, 77 ref.

Descriptors: Water pollution control, *Microorganisms, *Diatoms, Water pollution effects.
Identifiers: *Asterionella notata, *Cellular extract.

Asterionella notata Grun were investigated in solid media and liquid media. Properties of the cultures and antibiosis of the diatom was studied. The cellular extract of this marine micro-algae was found to be specific against many aerobic terrestrial saprophyte, some marine bacteria, fungi and yeasts. This cellular extract's active substance is secreted by the algae in its own culture media and may be able to fight -in situ- against the terrestrial polluting bacterial flora. (Ensign-PAI)
W71-06211

MAYFLY DISTRIBUTION AS A WATER QUALITY INDEX,
Winona State Coll., Minn.
For primary bibliographic entry see Field 05A.
W71-06248

SOME FACTORS INFLUENCING TOXICITY OF LINEAR ALKYLATE SULFONATE (LAS) TO THE BLUEGILL,
National Water Quality Lab., Duluth, Minn.
Kenneth E. F. Hokanson, and Lloyd L. Smith, Jr.
Transactions of the American Fisheries Society, Vol 1, No 1, p 1-12, January 1971. 3 fig, 10 tab, 22 ref. Paper No 6880, Scientific Journal Series, Minn. Agricultural Experiment Station, St. Paul, MN.

Descriptors: *Linear alkylate sulfonate, *Water pollution effects, *Bluegill, *Life history studies, *Bioassay, Lethal limit, Detergents, Hardness (Water), Oil, Water temperature, Dissolved oxygen, Toxicity, Surfactants, *Water quality.
Identifiers: *Mississippi River, Lethal threshold concentration, Application factor, Bentonite suspensions.

Some factors influencing toxicity of linear alklate sulfonate (LAS) on the early life history stages of the bluegill, Lepomis macrochirus (Rafinesque), were studied in raw Mississippi River water under ambient conditions and under controlled conditions in well water. Median response varied from 0.2-10 mg/l LAS with the life history phase and environmental conditions. Variation in estimation of TLm values within and between similar tests was small in comparison to the influence of external factors. The most important environmental factors related to lethal threshold concentration of LAS were dissolved oxygen, water hardness, and acclimation to LAS. High temperature decreased the median tolerance limit only during tests of short exposure. Sublethal concentrations of LAS increased toxicity of fuel oil mixtures while bentonite suspensions up to 200 mg/l had little influence on LAS toxicity. The most sensitive stage of development was the feeding sac-fry, while the most tolerant stage was the newly hatched sac-fry. Eggs and fingerlings had similar intermediate tolerance limits. Egg fertilization was the least inhibited of the events studied. A concentration of 1 mg/l LAS is considered to be a first approximation of a safe concentration for bluegills in Mississippi River water of good quality.
W71-06260

MARINE WASTE DISPOSAL AND SEA URCHIN ECOLOGY,
California Inst. of Tech, Pasadena.
John S. Pearse, Mary E. Clark, David L. Leighton, Charles T. Mitchell, and Wheeler J. North.
June 1970. 93 p, 8 tab, 32 fig, 21 ref. FWQA Program 18050 DNV.

Descriptors: Water pollution effects, Waste disposal, California, Outlets, *Plankton, *Nutrients, *Dissolved solids.
Identifiers: *Sea urchins, Kelp beds, Nutrient assimilation, Leptopel.

Between 1940 and 1960, certain kelp beds near submarine sewer outfalls in southern California deteriorated seriously. Dense urchin ponulations were observed destroying plants and preventing floral restoration. Economic losses totalled many millions of dollars. Possibly wastes nourish urchins and promote kelp bed deterioration by enhancing urchin survival. Our laboratory studies established

four potential nutritional pathways: (1) Urchins can absorb and assimilate dissolved organics. (2) Deposited organic-rich films (leptopel) can be eaten. (3) Larger plankton can be captured and eaten. (4) Microplankton and colloids can probably be assimilated. Outfalls probably contribute significantly to these pathways. Dissolved free amino acid concentrations were over 50 percent higher near an outfall vs. a control area. Leptopel deposits are always conspicuous near outfalls but elsewhere are often undetectable. High turbidities from suspensoids are characteristic of waste dispersal areas. Young urchins from barren outfall areas displayed about half the growth rates measured in well-fed laboratory animals. Barren outfall areas had higher proportions of large urchins compared to barren control areas. Proximity to an outfall ensured relatively high and constant nutritional condition (as measured by gonadal index). Compared to urchins in similar control areas, populations near outfalls were better nourished.
W71-06262

LACTIC AND PYRUVIC ACID CHANGES IN BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS RAFINESQUE) DURING GRADUAL HYPOXIA AT TWO ACCLIMATION TEMPERATURES (5 and 20C),
Virginia Polytechnic Inst., Blacksburg.
Dennis T. Burton.
The ASB Bulletin, Vol 17, No 2, p 35, April 1970.

Descriptors: *Fish physiology, *Acclimatization, *Animal metabolism, Sunfishes, Oxygenation, Oxygen requirements, Anaerobic conditions, Laboratory tests, Dissolved oxygen, Stress, Thermal stress.
Identifiers: *Lactic acid, *Pyruvic acid, *Hypoxia.

Changes in skeletal muscle and liver lactate and pyruvate concentrations during the development of hypoxia were studied at two acclimation temperatures, 5 and 20C. Experimental fish were exposed to a gradual eight-hour hypoxic stress. At both acclimation temperatures lactic acid increased in both muscle and liver at very low oxygen concentrations; the pyruvic acid concentration was relatively constant. Thus the lactate/pyruvate ratio increased at low oxygen concentrations. Lactic acid was higher at 20C than at 5C. Pyruvic acid concentrations were similar at both temperatures. Fish at 5C could tolerate lower oxygen concentrations than those at 20C, thus suggesting that acclimation to cold temperatures has survival value for fish exposed to hypoxia. (Sjolseth-Washington)
W71-06320

THE INFLUENCE OF ACCLIMATION TEMPERATURE ON THE LIPID COMPOSITION OF FISH GILL MITOCHONDRIA,
Duke Univ., Beaufort, N.C. Marine Lab.
Richard S. Caldwell, and F. John Vernberg.
Comp Biochem Physiol, Vol 34, p 179-191, 1970. 3 tab, 1 fig, 48 ref. NSF Grant G-17669.

Descriptors: *Acclimatization, *Fish physiology, *Lipids, *Biochemistry, Water pollution effects, Water temperature, Environmental effects, Gas chromatography, Animal metabolism, Bullheads, Thermal stress, Mode of action, Biological membranes
Identifiers: *Phospholipids, *Fish gill mitochondria, *Fatty acids, *Thermal acclimation.

The phospholipid fraction of goldfish gill mitochondria contained proportionately more cardiolipin and phosphtidyl ethanolamine and less sphingomyelin at 10C than at 30C but total phospholipid phosphorous levels remained unchanged. The total mitochondrial lipids from both goldfish and yellow bullhead gill tissues were more unsaturated at the colder acclimation temperatures. Generally, the levels of saturated and monounsaturated fatty acids were reduced and polyunsaturated fatty acids were increased in both species at the lower temperature. Changes in mitochondrial lipid composition presumably assist in maintaining a specific molecular organization over a wide range of environmental temperatures. (Sjolseth-Washington)
W71-06321

A POTENTIAL CONTROL FOR LEECHES,
Bureau of Sport Fisheries and Wildlife, Stuttgart, Ark. Fish Farming Experiment Station.
Fred P. Meyer.
The Progressive Fish Culturist, Vol 32, p 160-163, July 1970. 16 ref, 1 tab.

Descriptors: *Fish parasites, *Bioassay, *Toxicity, *Evaluation, Chemcontrol, Fish management, Organophosphorous pesticides, Carbamate pesticides, Fish hatcheries, Fishkill.
Identifiers: *Leeches, *Dylox, *Baygon, *Baytex, Placobdella parasitica, Erpobdella punctata, Illinobdella moorei, Piscicola salmositica, Theromyzon.

Leeches pose a large problem in fish hatcheries as they have been responsible for numerous fish losses. Controls for leeches are generally unknown. The purpose of this study was to determine the toxicity of Dylox, Baytex (organophosphorous pesticides) and Baygon (a carbamate pesticide) to five species of leeches; Erpobdella punctata, Illinobdella moorei, Pisciocola salmositica, Placobdella parasitica and Theromyzon sp. All three insecticides affected the leeches but only Dylox, at levels of 0.25 ppm and above, appeared to cause permanent damage to all species. The author feels that Dylox has potential as a control agent for leeches and merits further study. (Sjolseth-Washington)
W71-06322

SOME EFFECTS OF ANTIMYCIN IN AN OLIGOTROPHIC LAKE,
Idaho Univ., Moscow. Dept. of Biological Sciences.
Fred W. Rabe, and Robert C. Wissmar.
The Progressive Fish-Culturist, Vol 31, p 163, July 1969.

Descriptors: *Antimycin-A, *Toxicity, *Fishkill, *Fish food organisms, *Zooplankton, Fish toxins, Fish control agents, Fish management, Benthic fauna, On-site investigations, Daphnia, Cutthroat trout, Idaho, Water pollution effects, Lakes.
Identifiers: *Copper Lake (Idaho), Tin Lake (Idaho).

Antimycin A was applied to Copper Lake in Idaho at a rate of 5 parts per billion. Within 24 hr there occurred a total fish kill of 282 cutthroat trout. Ten days after the poisoning, a sample of six 1-inch cutthroat exposed to the water died within 12 hr. A year before this treatment, plankton hauls in Copper Lake and in nearby Tin Lake had provided counts of 31 and 33 microcrustaceans per liter respectively. Thirteen days after poisoning, no living crustaceans were found in Copper Lake samples, but 82 per liter were found in Tin Lake samples. A year after poisoning Copper and Tin Lakes yielded 25 and 43 microcrustaceans per liter respectively. (Sjolseth-Washington)
W71-06323

METABOLISM OF QUINALDINE (2-METHYLQUINOLINE). UPTAKE AND EXCRETION BY NURSE SHARKS,
National Inst. of Neurological Disease and Stroke, Bethesda, Md. Lab. of Neurochemistry.
Eberhard G. Trams, and Elise A. B. Brown.
Life Sciences, Vol 9, Part 2, p 27-35, 1970. 3 fig, 1 tab, 7 ref.

Descriptors: *Sharks, *Quinaldine, *Excretion, Kinetics, Water pollution effects, *Metabolism, *Absorption, Fish physiology.
Identifiers: Nurse sharks, Sheepshead, Cow-nosed rays.

The studies demonstrated that the uptake and excretion of quinaldine in the nurse shark appear to follow certain rules of kinetics. It was assumed that the rate of uptake and excretion in the experiments was partially dependent on the transport limits of the gills. It was thought conceivable that the lipophilic drug may be absorbed and excreted, in part, by the skin. The preliminary observations on the tissue distribution of quinaldine showed appreciable concentrations in the central nervous system. Quinaldine should become a valuable drug for the handling of a variety of fish. (Wahtola-Washington)
W71-06324

EFFECTS OF ALKYL BENZENE SULFONATE ON RAINBOW TROUT,
Utah State Univ., Logan. Dept. of Wildlife Resources.
T. J. Hassler, J. M. Neuhold, and W. F. Sigler.
U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Technical Papers No 16, 1967. 15 p, 6 fig, 6 tab, 31 ref.

Descriptors: *Alkylbenzene sulfonates, *Rainbow trout, *Detergents, *Bioassay, Toxicity, Mortality, Laboratory equipment, Tracers, *Fish physiology, Fish behavior, *Respiration, Lethal limit.
Identifiers: *LC-50, Hematocrits, Leucocytes, Mucous cells, Sulfur-35.

The effects of alkyl benzene sulfonate on rainbow trout, Salmo gairdneri, were described. Toxicity of detergent levels was determined by probit analysis. Effects on gill tissues and blood were noted and measured. The LC-50 was 3.48 mg/liter ABS after 24 hr exposure, and 2.53 mg/liter after 120 hr. Initial increase in respiratory rate was followed by loss of equilibrium, violent and erratic swimming, lethargy and death. Microhematocrit values, circulating red blood cells, total plasma proteins, leukocytes, and the number of mucus cells on the gill filament tips increased as ABS concentration increased, and decreased with time. Destruction of gill tissues was severe. The respiratory surface was greatly reduced by lysis and clumping of the lamellae. Edema in the epithelial cells of the lamellae and thrombi in the capillaries were evident. (Wahtola-Washington)
W71-06325

A PRELIMINARY STUDY OF THE FEEDING RELATIONSHIPS OF FISH IN A HARD-WATER AND A SOFT-WATER STREAM IN SOUTHERN ENGLAND,
Freshwater Biological Association, Wareham, (England). River Lab.
R. H. K. Mann, and D. R. O. Orr.
Journal of Fisheries Biology, Vol 1, p 31-44, 1969. 6 fig, 5 tab, 24 ref.

Descriptors: *Food habits, Statistics, Fish populations, Aquatic insects, Seasonal, Water pollution effects, *Trout, *Salmon, *Bullheads, *Minnows, Hydrogen ion concentration, Alkalinity, Conductivity, *Hardness (Water), Fish physiology.
Identifiers: Soft water.

The feeding relationships of fish in hard-water and soft-water streams in southern England are reported. The results can be summarized as follows: (1) the food of trout, salmon, bullheads, minnows and sticklebacks from a chalk stream, and trout and minnows from an acid stream were investigated by examination of 2659 stomachs collected between October, 1965 and September 1967, (2) although fish at each stream feed on similar invertebrate organisms, they do so in different proportions and these proportions may vary with the size of the fish, species of fish, season and type of habitat, (3) variation in fish diets within samples is often greater than between successive monthly samples, and (4) Docken's Water trout eat more Plecoptera nymphs and Gammarus than Bere Stream trout, but less Ephemeroptera nymphs and molluscs. (Wahtola-Washington)
W71-06327

AN ELECTRODE CHAMBER FOR RECORDING RESPIRATORY AND OTHER MOVEMENTS OF FREE-SWIMMING ANIMALS,
National Water Quality Lab., Duluth, Minn.
For primary bibliographic entry see Field 05A.
W71-06328

INTRODUCTION: ISSUES IN FOOD PRODUCTION AND CLEAN WATER,
Agricultural Research Service, Beltsville, Md. Water Conservation Research Div.
For primary bibliographic entry see Field 05G.
W71-06429

CHEMISTRY OF SEDIMENT IN WATER,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div; and Minnesota Agricultural Experiment Station, St. Paul.
For primary bibliographic entry see Field 05B.
W71-06431

SIGNIFICANCE OF PHOSPHORUS IN WATER SUPPLIES,
Southern Illinois Univ., Carbondale. Dept. of Botany.
For primary bibliographic entry see Field 05B.
W71-06433

CHEMISTRY AND METABOLISM OF INSECTICIDES,
Iowa State Univ., Ames. Dept. of Zoology and Entomology.
Paul A. Dahm.
Journal Paper No. J-6509 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter II, p 167-182. 6 fig, 1 tab, 62 ref.

Descriptors: *Insecticides, *DDT, *Aldrin, Dieldrin, Insects, Carbamate pesticides, Insect control, Metabolism, Organophosphorus pesticides, Chlorinated hydrocarbon pesticides, Pesticide toxicity, Pesticide residues.
Identifiers: Toxaphene, Parathion, Malathion, Carbaryl, Metabolites, Arthropods.

Insecticides occur in the environment because of purposive applications for pest control and because of accidents and carelessness. The major problems with insecticides arise from the contamination of the environment and food and the development of resistant arthropod-pest populations. The persistence of insecticides in the atmosphere, water, soil, plants, animals, and microorganisms is being investigated. Alterations of insecticides occur under both metabolic and nonmetabolic conditions. Knowledge of the metabolism of insecticides is prerequisite to their development and use for insect control. Identification and toxicological assessment of the metabolic products should precede establishment of residue and other safety factors. More basically, metabolism studies of insecticides reveal intoxication and detoxication processes and how these relate to physiological effects and problems of resistance. With some insecticides, primary metabolic attack may form compounds whose toxicity approximately equals or is greater than the parent insecticide. Numerous nonmetabolic factors exert effects on the structure and persistence of insecticides. The solubilities of insecticides in soil and water are especially important in relation to their movement and persistence in the environment. (See also W71-05437) (White-Iowa State)
W71-06438

EFFECTS OF AGRICULTURAL POLLUTION ON EUTROPHICATION,
Wisconsin Univ., Madison. Dept. of Sanitary Engineering, and Wisconsin Univ., Madison. Dept. of Water Chemistry.
D. E. Armstrong, and G. A. Rohlich.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 23, p 314-330. 14 tab, 2 fig, 26 ref.

Descriptors: *Eutrophication, *Nitrogen, *Phosphorus, Nutrients, Algae, Nitrates, Surface runoff, Base flow, Percolation, Leaching, Drainage, Farm wastes, Soil management, groundwater, Wisconsin, Water supply.
Identifiers: *Agricultural drainage, Lake metabolism, Mobility, Particulate form, Feedlots, Nutrient sources.

The paper discusses nitrogen and phosphorus transport in agricultural drainage since these are the most important nturients involved in eutrophication. It is generally expected that inorganic nitrogen is transported mainly as nitrate by percolating water, although the amounts of ammonium and nitrate carried in runoff waters may be highly significant in terms of the receiving water. Similarly, the largest amount of phosphorus is likely transported in particulate form in runoff waters, but the amount of dissolved phosphorus in runoff water may be of equal or greater importance even though lower in quantity. The contribution of agricultural drainage to the nitrogen and phosphorus status of waters is next examined. The data presented suggest that agricultural land is an important contributor of nitrogen and phosphorus to water. About 60% of the nitrogen and 42% of the phosphorus were estimated to come from agricultural land. Nutrient budget estimations were based on data obtained on a small scale and extrapolated and thus have a low reliability. Nutrient sources are numerous and generalizations as to which source is the most important cannot be made. The contribution of agriculture should be reduced by improved and more efficient agricultural management practices. (See also W71-05437) (White-Iowa State)
W71-06443

EFFECTS OF AGRICULTURAL POLLUTANTS ON RECREATIONAL USES OF SURFACE WATERS,
Missouri Univ., Columbia. Dept. of Zoology; and Missouri Dept. of Conservation, Columbia.
Robert S. Campbell, and James R. Whitley.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 24, p 331-343. 3 tab, 1 fig, 43 ref.

Descriptors: *Pollutants, *Recreation, Lakes, Streams, Algae, Pesticides, DDT, Return flow, Sediments, Soil erosion, Fertilizers, Farm wastes, Fish, Fish eggs, Turbidity, Nutrients, Dissolved oxygen, Nitrogen, Phosphorus, Water Quality Act, Water quality.

Unquestionably many agricultural pollutants affect recreation through alteration of water quality and degradation of fish and aquatic life. The more serious polluting agents are eroded soil, agricultural fertilizers, animal wastes, and pesticides. While the problems relating to agricultural pollution are complex, and the solutions will not easily be attained, it seems reasonable that in many instances alternative procedures can be developed. Pollution control measures are available which will allow continuation of agricultural production and enhance and protect water quality and recreation. While these procedures may be costly to apply, the expenditure should be judged in light of its contribution toward the preservation of man's environment. Especially in the instance of pesticide use, protection of water quality may be requisite to protection of the health of man from unknown long-term effects of pesticides. Reduction and control of agricultural pollutants are essential to develop and maintain a high quality environment. Quality of life and quality of environment are synonymous. (See also W71-05437) (White-Iowa State)
W71-06444

EFFECT OF SOIL TEMPERATURE ON THE AVAILABILITY OF PHOSPHORUS IN ANIMAL MANURES,
California Univ., Davis.
J. L. Abbott, and J. C. Lingle.
Soil Science, Vol 105, No 3, p 145-152, 1968. 3 tab, 5 fig, 14 ref.

Descriptors: *Farm wastes, *Phosphorus, Water pollution effects, Nutrients, Organic matter, Nitrogen, Carbon dioxide, Soil temperature, Plant growth.
Identifiers: *Animal manure, Available phosphorus, Plant response.

Steer, dairy, sheep, and poultry manures, and alfalfa supplemented with monocalcium phosphate added to two slightly acid soils at the rate of 50 ppm. total P and supplied plant-available P to two successive crops - turnips and tomatoes. Dry-weight yield and total P in the tissues provided data for evaluating plant-available P in the manures. In the Sierra sandy loam at the medium soil temperature, uptake of P by turnips was greater from the sheep, poultry, and alfalfa plus PO4 treatments than from the dairy manure treatment. In the Gridley clay loam at 15 deg C. soil temperature, uptake of P by turnips was greater from the poultry manure treatment than from the other treatments. Soil temperature had no measurable effect on the availability of manurial P to tomatoes. At all soil temperatures, P-solubilizing processes, including mineralization of the organic P in both soils and amendments, appeared to contribute to the P absorbed by plants. These processes appeared to continue during the second cropping period, notably at the low (20 deg C.) soil temperature, after having been previously cropped for 5 weeks and incubated for 3 weeks at 15 deg C. Manures yielded more available P in the Sierra than in the Gridley soil. From these data, the HOAc-soluble:nonsoluble P ratios of manures could not be said to have influenced the availability of manurial P to plants. On an equal dry-weight basis, the overall effectiveness of manures in supplying available P depended on their respective total P contents: poultrySsheepSsteer — dairy. (Christenbury-Iowa State)
W71-06455

5D. Waste Treatment Processes

RECOVERY OF URANIUM FROM NATURAL MINE WATERS BY COUNTERCURRENT ION EXCHANGE,
Bureau of Mines, Salt Lake City, Utah. Salt Lake City Metallurgy Research Center.
J. R. Ross, and D. R. George.
Bureau of Mines Report of Investigations RI-7471, January 1971. 17 p, 11 fig, 1 tab.

Descriptors: *Ion exchange, *Uranium radioisotopes, *Leaching, *Mine water, *Mine drainage, Mine wastes, Separation techniques, Resins, New Mexico, Waste water treatment.
Identifiers: *Uranium recovery.

Recovery of uranium from slightly alkaline mine water, available in the Ambrosia Lake district of New Mexico, was studied using countercurrent ion exchange columns. Approximately 5 million gallons of mine water containing 9 to 12 ppm U was treated by ion exchange. Uranium recoveries averaged in excess of 98 percent at solution flows ranging from 15 to 25 gallons per square foot per minute and resin loadings up to 3.6 pounds to U per cubic foot. Loaded resin was continuously eluted in a countercurrent elution column with a diameter of 4 inches and containing a bed of resin 9 feet deep. The resin was eluted to a residual loading of less than 0.06 pound of U per cubic foot, at a resin-retention time of 224 minutes, using only 1.9 volumes of 1.1 M NaCHO3 solution per volume of resin. Compared with existing ion exchange practices for recovering uranium from mine waters in the Ambrosia Lake district of New Mexico, use of these improved ion exchange contactors would reduce ion exchange resin requirements at least 70 percent. (Knapp-USGS)

W71-05841

NORTH SIDE TREATMENT PLANT CHLORINATION,
Metropolitan Sanitary District of Greater Chicago, Ill. Dept. of Research and Control.
Jeanne Johnson.
Metropolitan Sanitary District of Greater Chicago, Dec 20, 1968. 20 p, 7 fig, 2 tab, 3 ref.

Descriptors: *Chlorination, *Waste water, *Sewage effluents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Bacteria, Scum, Coliforms, Illinois.
Identifiers: *Chicago (Illinois), *Chlorine dosage.

The report summarizes field observations and tests of the results of chlorination at the District's North Side Treatment Plant, made in 1968. The results of using the North Shore Channel as a partial contact chamber are discussed including the method of using an interpolated count in lieu of an actual count at the 30 minute contact point. Correlations between chlorine dosages, chlorine residuals and bacterial densities are presented, and the most practical and effective dosage as well as how the meeting of SWB-15 requirements should be evaluated is suggested. It was concluded that if the North Shore Channel is to be used as a partial contact chamber, it is valid to interpolate a bacterial count for the 30 minute point only when no stormwater is being discharged in the sampling area, and when sufficient replicate samples are taken to arrive at a meaningful average bacterial density. It was found to be more practical to use a single chlorine dosage based on plant flow, as is presently practiced at the Northside Plant, rather than chlorine residual control. The dosage found to meet SWB-15 requirements at the outfall 100% of the time sampled was 1.25 p.p.m. The next lowest dosage used, 1.00 p.p.m., did not meet requirements 100% of the time even with the contact time extended to 30 minutes. The scum condition on the North Shore Channel experienced during chlorination appears to be caused by grease coming from the plant. (Poertner)
W71-05925

PHOSPHATE REMOVAL FORM TERTIARY EFFLUENT WITH ION EXCHANGE MATERIALS,
Metropolitan Sanitary District of Greater Chicago, Ill.
Howard Stethers.
Metropolitan Sanitary District of Greater Chicago, January 22, 1968. 26 p, 15 fig, 1 tab.

Descriptors: *Phosphates, *Phosphorus, *Ion exchange, *Tertiary treatment, *Waste water treatment, Pilot plants, Demineralization, Water chemistry, Anion exchange, Water quality, Water quality control, Water purification, Water pollution treatment, Laboratory tests, Illinois.
Identifiers: *Activated alumina, *Anion exchange resins

The tertiary treatment facilities at the District's Hanover Plant are expected to yield an effluent high in phosphate and low in nitrogen content. Chemical methods were studied for removing the phosphates without increasing the content of other anions to determine the better methods for bench scale testing. The ion exchange process was the only one investigated on a bench scale because the process costs and technology of this method offered an acceptable solution to the removal of phosphates from the effluent. The most important result obtained in these experiments was to show that activated alumina selectively removes phosphates from solutions that contain phosphates, sulfates and chlorides. The following conclusions were drawn from the study (1) either anion exchange resins or activated alumina may be used to remove phosphates from the effluent, (2) the best anion resin was that supplied by Illinois Water Treatment Company under the designation A-324-C, (3) the best activated alumina was the chromatographic grades, however, the cost will eliminate these materials for production use; (4) activated alumina pellets gave very acceptable results and do not appear to be too expensive; (5) activated alumina chips give a good removal rate for phosphate and are the cheapest material tested. The investigator recommended that an automatically operated pilot plant having an ion exchange column of about 15,000 gal./day capacity be built to study recycle times and the resistance of activated alumina particles to size degradation. (Poertner)
W71-05926

FE CL3 ADDITION EXPERIMENTS FOR IMPROVED EFFLUENT QUALITY AT THE CALUMET TREATMENT PLANT, INTERIM REPORT,
Metropolitan Sanitary District of Greater Chicago, Ill. Research and Development Lab.
Clark L. Weddle, and George R. Richardson.
Metropolitan Sanitary District of Greater Chicago, May 9, 1969. 41 p, 14 fig.

Descriptors: *Sewage effluents, *Waste water, *Sewage treatment, *Waste water treatment, *Flocculation, *Coagulation, Settling velocity, Sedimentation rates, Suspension, Chemical precipitation, Bacteria, Water pollution treatment, Illinois.
Identifiers: *Ferric chloride, Organic polymer, Coagulation aids, Calumet (Illinois).

The Calumet Research Project was started as a result of an unsatisfactory effluent quality observed during the end of December, 1968, and January and February, 1969. Microscopic examination of the solid material in the effluent revealed that this material was small, highly dispersed, bacterial floc which settled very poorly. It was therefore proposed that the addition of a coagulant, such as FeCl3, and/or a coagulant aid, such as an organic polymer, may enhance the formation of larger floc particles resulting in better solids separation in the final clarifier and an improved effluent quality. To determine the effectiveness of these chemical additions, a series of laboratory investigations were conducted which indicated that additions of FeCl3 and Hercufloc 814 organic polymer would reduce the effluent suspended solids concentration. As a result of these laboratory experiments, an experimental program was established along with necessary plant modifications and plant operation to ascertain the effectiveness of these chemicals on a plant scale basis. The report presents the results of the experiments conducted on the addition FeCl3 to one half of one battery at the Calumet Plant. (Poertner)
W71-05927

FIELD INVESTIGATION OF ENVIRONMENTAL EFFECTS OF COOLING TOWERS FOR LARGE STEAM ELECTRIC PLANTS,
Portland General Electric Co., Oreg. Dept. of Engineering Design.
D. J. Broehl.
April 1, 1968. 28 p.

Descriptors: *Cooling towers, *Fog, *Mist, *Nuclear powerplants, *Environmental effects, *Cooling water, Water vapor, Meteoric water, Environmental engineering, Artificial precipitation, Condensation, Thermal powerplants, Heated water, Heat exchangers.
Identifiers: *Cooling tower effects, *Hyperbolic cooling towers, Steam-electric plants, Heat disposal.

The Portland General Electric Company made field inspections of steam-electric generating plants located in the coal mining region of the Appalachian Mountains. The purpose was to observe possible fogging, misting or icing produced by the operation of cooling towers at these plants. This information was to be used by the company in designing the cooling towers for its Trojan nuclear plant. Four of the plants visited use natural draft hyperbolic cooling towers. They range in height between 325 to 400 feet, and in base diameter from 180 to 400 feet. These towers have a total of 6 1/2 years of operating time in climates having more extreme variations than the Trojan plant site. Vapor plumes from the large natural draft towers do not produce ground level fog, even under the most adverse weather conditions. Plume lengths were found to be less than 400 feet most of the time. Induced draft cooling towers were also found satisfactory for the Trojan plant; however, there is a possibility of substantial ground-level fog within a quarter-mile of the towers. It was estimated that the cooling towers for the Trojan plant will cost between 9 and 12 million dollars and that towers will provide a satisfactory means of heat disposal. (Poertner)
W71-05930

PROBLEMS IN DISPOSAL OF WAST HEAT FROM STEAM-ELECTRIC PLANTS.
Federal Power Commission, Washington, D.C. Bureau of Power.
For primary bibliographic entry see Field 08A.
W71-05931

FACTORS IN WASTE HEAT DISPOSAL ASSOCIATED WITH POWER GENERATION,
Federal Power Commission, Washington, D.C.
For primary bibliographic entry see Field 08A.
W71-05932

DETERMINATION OF THE BIODEGRADABILITY OF ANIONIC SYNTHETIC SURFACE ACTIVE AGENTS.
Organisation for Economic Co-Operation and Development, Paris (France).

Organisation for Economic Co-Operation and Development, Paris, No 78.728, 1970. 30 p, 4 fig, 1 append.

Descriptors: *Detergents, *Biodegradation, *Test procedures, Sewage treatment, Biological treatment, Model studies, Activated sludge, Water pollution sources, Surfactants.
Identifiers: Methylene blue active substances, International test procedures, Detergent industry, Surface active agents.

This report proposes a system of analyses that could predict the biodegradability of anionic surface active agents under conditions of biological sewage treatments. The system comprises two stages: a screening or a static test of the 'open flask' type, based on degradation of methylene blue active substance (MBAS); a confirmatory test simulating biological treatment of sewage in a small version of an activated sludge plant. The latter procedure involves daily determinations of the MBAS concentration in the effluent, the results being expressed in per cent as arithmetic averages for 21 days or for a longer period not exceeding 6 weeks. The proposed system was subjected to trials in 29 laboratories of 13 countries. (Wilde-Wisconsin)
W71-05990

ECOLOGY OF SELECTED BACTERIA IN A SMALL INTERMITTENT SEWAGE POND,
Utah State Univ., Logan. Dept. of Bacteriology.
F. J. Post.
Water Research, Vol 4, p 341-351, 1970. 6 fig, 6 tab, 13 ref.

Descriptors: *Coliforms, *Bacteria, *Oxidation lagoons, Viruses, Pathogenic bacteria, Utah, Waste water treatment, Ecology, Sewage treatment, Analysis, Enteric bacteria, Regression analysis.
Identifiers: Fecal indicators, Logan (Utah), Escherichia coli, Oscillatoria, Beggiatoa, Sphaerotilus natans.

A 24-hour retention sewage oxidation pond in Logan, Utah, had been studied to determine whether a relationship exists between population levels of certain bacteria and selected physical fac-

ors of the environment. When the pond was first illed a biological mat developed predominantly of Oscillatoria type accompanied by Beggiatoa type with sulfur inclusions. A close parallel was found between outlet water temperature and certain groups of special fecal indicators. Fecal enterococci (as measured by the KF method) proved to be he most sensitive to environmental conditions with correlation coefficient to temperature cubed of -).857. Fecal Escherichia coli were also highly sensitive with a correlation coefficient of -0.752, the atter most sensitive of the coliform group as a vhole (-.608). Bacterial antagonism as well as algal ctivity may be significant; other possibilities include bacteriophage, protozoa, and invertebrate oragers. The total count at 20C appears to be an nsensitive indicator of pond activity as it only eflects numerical levels of decomposing bacteria. Knowledge of the casual nature of these changes nay benefit the design of oxidation ponds and unerstanding the role of bacteria in transformation f organic matter. (Jones-Wisconsin)
V71-05995

REATMENT OF FISH HATCHERY EFLUENT FOR RECYCLE,
lew Mexico State Univ., University Park. Dept. of ivil Engineering.
. P. Gigger, Jr., and R. E. Speece.
vailable from NTIS as PB-198 088, $3.00 in aper copy, $0.95 in microfiche. Technical Report umber 67, Engineering Experiment Station, ovember 1970. 119 p, 25 tab, 26 fig, 23 ref. WRR Project A-018-N MEX (3).

escriptors: *Fish hatcheries, *Ammonia, *Filtraon, Turbidity, Nitrogen, Biochemical oxygen deand, Aeration, Filters, New Mexico, Waste water eatment.
lentifiers: *Recycle, Nitrifying bacterial filters, lchesay National Fish Hatchery (N Mex).

he removal of ammonia from fish hatchery efuents using nitrifying bacterial filters was demonrated in pilot plant experiments. The filters used this study showed maximum ammonia removal tes of from 150-200 milligrams of ammoniatrogen per hour per cubic foot of filter and the nmonia removal rates in the filters increased ghtly as flow rates increased. This experiment so showed the effect of water recycle on water uality and the feasibility of using a 100% recycle stem on a large scale at Alchesay National Fish atchery during period when the regular water urce is unsuitable for use due to high turbidity vels. Higher recycle rates caused lower ammonia ncentrations under equilibrium conditions and e additional effects of filtration included removal turbidity and a considerable consumption of oxen in the reduction of carbonaceous BOD. The ualitative behavior of rainbow trout subjected to cycle conditions was observed and it was conuded that when filter size and aeration were equate, fish hatchery effluent could be treated in trifying bacterial filters and recycled without any verse effects on these fish. Mechanical difficules prevented satisfactory operation of the large ale recycle experiment. (Ellis-Texas)
71-06024

TUDY AND EXPERIMENTS IN WASTE ATER RECLAMATION BY REVERSE OSMOS,
ulf General Atomic Inc., San Diego, Calif.
Nusbaum, J. H. Sleigh, Jr., and S. S. Kremen.
or sale by the Superintendent of Documents, US overnment Printing Office, Washington, DC. 402, Price $1.25. SOD order no 7.13/4:17040.05/10. Available from NTIS as -198 092, $3.00 in paper copy, $0.95 in crofiche. Water Pollution Control Research Ses, 17040-05/70, May 1970. 116 p, 8 tab, 48 fig, 5 f, append. FWQA Program 17040-05/70.

escriptors: *Reverse osmosis, *Brine, *Memanes, Activated sludge, Activated carbon, paration techniques, Acidity, Fouling, Chlorine, Chemical oxygen demand, Waste water treatment, Chemical precipitation, Osmosis, Mebrane processes, Demineralization.
Identifiers: *Flux, Modules, Spacers.

Current reverse osmosis technology was applied to the treatment and demineralization of secondary effluents to determine what operational problems may occur, and develop methods of alleviating them. Two parallel reverse osmosis systems, with 50 ft sq spiral-wound reverse osmosis modules, were operated and results for activated sludge effluent versus activated carbon treated activated sludge effluent were compared. Fouling problems were encountered for which previously developed cleaning techniques were ineffective. An enzyme-based detergent technique was developed which alleviated the problem and restored performance. The size of the brine spacers affected only the pressure drop across the modules, and not the overall performance. Also the quantity of water handled would, over a 3 year period, be substantially more than could be handled by standard flux-high selectivity membranes. (Lowry-Texas)
W71-06025

PROCESS MODELING OF BIOLOGICAL WASTE TREATMENT,
Texas Univ., Austin.
D. M. Himmelblau, and E. F. Gloyna.
Available from NTIS as AD-715 726, $3.00 in paper copy, $0.95 in microfiche. Annual Progress Report no 2, October 10, 1970. 14 p.

Descriptors: *Mathematical models, Aerobic treatment, Biomass, Aeration, Tracer, Waste water treatment.
Identifiers: *Population balance techniques, *Mean residence time, *Complete mixing, Pulse injection, Concentration, Sodium-24, Variance, Agitation, Laboratory scale.

Laboratory scale aeration units have been employed to obtain and identify mathematical models of biological waste treatment. Sodium-24 was used as a tracer material since it doesn't affect the physical parameters of the fluid, it doesn't undergo any chemical reactions, and it is easily detectable in small concentrations. Data obtained is highly reproducible if periods of at least 8-10 residence times are used. However, the assumption of complete mixing was found to be applicable only in certain cases. When there wasn't complete mixing, results were not reproducible. (Lowry-Texas)
W71-06026

PORT ELGIN'S OXIDATION DITCH,
Mackay (A.M.) and Associates, Owen Sound (Ontario).
A. M. Mackay.
Water and Pollution Control, Vol 108, No 12, p 32-33, December 1970.

Descriptors: *Biodegradation, Waste water treatment, Rotors, Sludge, Chlorination, Activated sludge, Biochemical oxygen demand, Oxidation, *Oxidation lagoons.
Identifiers: Oxidation ditch, *Resort area, Extended aeration, Contact stabilization, Suspended solids, Ontario, Canada.

Port Elgin, Ontario, Canada, is a resort town with a population which fluctuates from 6,000 in the summer to 1,800 in the winter. When replacement of their waste treatment facilities became imperative, several alternatives, including conventional activated sludge and extended aeration, were investigated. The oxidation ditch plan was chosen. The final treatment system consists of one long and one short ditch, both agitated by large rotors. The long ditch is where most of the work is done, and the small ditch is for reaeration and storage of solids to be returned as needed. The system was built at a total cost of $420,000 and was designed for 8,000 people at a hydraulic loading of 1 MGD. So far, the effluent discharge from the plant has 2.5 mg/l of BOD and less than 7 mg/l of suspended solids. There has been no odor problem. Power cost and maintenance were $200 per month but are expected to rise to $270 per month, with total operational cost including chlorine then being $560 per month. (Lowry-Texas)
W71-06027

FILAMENTOUS MICROORGANISMS AND THE BULKING OF ACTIVATED SLUDGE,
Rutgers-the State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
M. S. Finstein, and H. Heukelekian.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 175-181, July 1965. 4 fig, 1 tab, 8 ref.

Descriptors: *Microorganisms, *Activated sludge, Waste water treatment, Microbiology.
Identifiers: *Bulking, Sludge volume index.

Quantitative data with which to assess the influence of filamentous microorganisms on the settleability of activated sludges is presented. Flocs from 4 activated sludge plants were characterized with respect to their diameters and total length of associated filamentous microorganisms per floc. Flocs ranged from 0.02-0.2 mm in diameter and 0.0-2.0 mm in length. No consistent relationship was found between floc diameter and SVI but the more filamentous samples invariably had a higher SVI. (Ellis-Texas)
W71-06028

SHEARING EFFECTS ON SETTLING OF ACTIVATED SLUDGE,
California Univ., Davis.
Richard A. Bradley, and Ray B. Krone.
Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 97, No SA1, p 59-79, February 1971. 9 fig, 1 tab, 24 ref.

Descriptors: *Activated sludge, *Shear, Coagulation, Colloids, Flocculation, Suspensions, Settling velocity, Sedimentation, Waste water treatment.
Identifiers: *Agglomeration, Velocity gradient, Break-up.

Degree of shear in a settling basin was investigated as to its effect on settling of activated sludge. The two main effects of shear are the aggregation of sludge particles and the break-up of such aggregates, and experiments were performed on both conditions. Attempts were made to hold all variables on other than the settling properties and the shear rate constant to preclude changes either in the viscosity or the physical state. All tests were conducted in a bench scale apparatus of approximately 3.0 l capacity. Optimum shearing rate for the activated sludge studied was determined to be 15 per sec, and this amount of shear significantly enhanced the aggregation of activated sludge particles, and their separation by settling from the suspending water. (Lowry-Texas)
W71-06029

FUNDAMENTAL ASPECTS OF SURFACE AERATOR PERFORMANCE AND DESIGN,
Mixing Equipment Co., Rochester, N.Y.
J. R. McWhirter.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 75-92, July 1965. 10 fig, 24 ref.

Descriptors: *Aeration, *Oxygen, Oxygenation, Waste water treatment, Mass transfer, Reaeration, Oxidation, Activated sludge.
Identifiers: *Surface aerators.

A comparison of unsteady-state aeration of pure tap water, steady-state aeration of pure tap water, steady-state oxidation of sulfite solution, and steady-state aeration of activated sludge was made to evaluate surface aeration equipment. In testing surface aerators, it is extremely difficult to prevent a concentration gradient from developing in the liquid at the start of the reaeration which causes a

low calculation of the mass transfer coefficient. Proper interpretation of sulphite oxidation data can only be made by taking into account the effect of the rapid sulphite-oxygen uptake on the overall mass transfer rate. Sulphite oxidation data show higher oxygen uptake rates than corresponding steady-state reaeration data in addition to showing a different temperature variation and a significant variation in oxygen uptake rates with different catalysts. The unsteady-state reaeration technique is the most widely used and accepted method of determining the mass transfer coefficients or oxygenation capacity of aeration devices. (Ellis-Texas)
W71-06030

MOISTURE TRANSPORT IN SLUDGE DEWATERING AND DRYING ON SAND BEDS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Hsi Tang Ning, K. B. Schnelle, Jr., and F. L. Parker.
Technical Report No 18, 1969. 198 p, 19 tab, 68 fig, 20 ref, 4 append. FWQA Program 17070 DIV.

Descriptors: *Moisture content, *Sludge, *Dewatering, Gamma rays, Attenuation, Sludge disposal, Waste water treatment, Chemical precipitation.
Identifiers: *Sand beds.

The specific aim of this study is as follows: (1) to determine the moisture content in the sludge layer as well as in the sand layer by the gamma-ray attenuation technique; (2) determine the drainage characteristics of sludge having various initial depths; (3) determine the effects of evaporation from the sludge surface on the drainage process of the sludge; (4) to study the moisture transport phenomenon both in the sludge cake and in the sand beds under various conditions; and (5) to study the effect of sludge with chemical conditioners on the dewatering rate on sand beds. The gamma-ray attenuation technique can be used to determine the moisture content of the sand layers but determination of sludge moisture leaves much to be desired. The weight difference method was shown to be an acceptable way to measure the average moisture content of the sludge. It was shown that the time required to complete the drainage flow of the sludge is a function of the initial sludge depth and the evaporation date and depth of the sand have little effect on the drainage process. The moisture in the sand layer is contained in the bottom 4-5 cm of the sand bed. Chemically conditioned sludges are dewatered considerably faster than are those not chemically conditioned. (Ellis-Texas)
W71-06031

PROCESS OPTIMA IN ACTIVATED SLUDGE,
Illinois Inst. of Tech., Chicago.
S. Polocsik, R. B. Grieves, and W. O. Pipes, Jr.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 197-209, July 1965. 5 fig, 1 tab, 4 ref. Public Health Service Training Grant no 5T1ES26-02.

Descriptors: *Activated sludge, *Baffles, *Aeration, Kinetics, Nutrients, Optimization, Waste water treatment.

An effort has been made to analyze the effects upon the activated sludge process of first, baffling the aeration tank to provide three completely-mixed compartments of varying fractional volumes; second, of varying the input distribution of the waste to the three compartments, and third, of varying the recycle flow to the three compartments. Two-phase and one-phase kinetics were employed, with the latter utilized for the case of no sludge recycle. Optimum operation is achieved by dividing the aeration tank volume by baffling into three equal size compartments. It is best to distribute the feed toward the front of the system while the recycle should be inserted toward the back end of the system. (Ellis-Texas)
W71-06032

EVALUATION OF SOME STABILIZATION PONDS IN INDIA,
Central Public Health Engineering Research Inst., Nagpur (India).
R. H. Siddiqi, and B. K. Handa.
Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 97, No SA1, p 91-100, February 1971. 7 fig, 1 tab, 11 ref.

Descriptors: *Oxidation lagoons, *Aerobic treatment, *Anaerobic conditions, Ponds, Climatic zones, Temperature, Turbulence, Oxygenation, Algae, Photosynthesis, Municipal wastes, Biochemical oxygen demand, Waste water treatment, Microorganisms.
Identifiers: Facultative microorganisms, India.

Climatic conditions in India are favorable to the operation of engineered waste stabilization ponds. Consequently, the treatment of wastes in such ponds is economically competitive with conventional biological treatment. Data collected from several installations in India were analyzed to determine what useful parameters of operation could be identified. Pond loading was found to be best expressed by a load factor, L sub f, which is the ratio of BOD load to algal produced oxygen. For L sub f between .44 and 8.0, the performance was determined from the following equation: E — 100 over (1 .. 0.188 L sub f or explanential to 0.48). From the preceding investigations, it was determined that the majority of organic matter destroyed is destroyed anaerobically. Therefore, ponds of depth greater than 5 feet are more efficient in their operation since there is less turbulence and less change of the anaerobes being exposed to oxygen. It was also determined that single cell reactors, or the first cell of a multi-cell arrangement maintain a higher destruction rate constant, with the rate of BOD reduction being described as a first order equation. The rate drops off with each successive cell in a multi-cell arrangement. (Lowry-Texas)
W71-06033

SOME EFFECTS OF HIGH SALT CONCENTRATIONS ON ACTIVATED SLUDGE,
Oklahoma State Univ., Stillwater. Bioengineering Labs.
D. F. Kincannon, and A. F. Gaudy, Jr.
Proceedings, Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, p 316-328, July 1965. 8 fig, 1 tab, 14 ref.

Descriptors: *Salts, *Activated sludge, Sodium chloride, Waste water treatment, Synthesis, Sludge.
Identifiers: Lysis, Substrate, Shock loading.

In previous experiments it was found that high salt concentrations could cause a severe decrease in the substrate removal rate and that long-term exposure to high salt concentrations caused a significant change in the ratio of respiration to synthesis. In the present study, experiments were designed to gain insight into the causal effects uncovered in the previous investigation, particularly with respect to shock-loading. For sludges developed in fresh water the substrate removal rate decreases at slug doses of 30,000 mg/l Na Cl but does not cause serious distress to the system. However, for mixed liquor concentrations of 45,000 mg/l there is severe impairment of substrate removal efficiency. Sludges grown in high salt concentrations were characterized by low carbohydrate and protein content, and abnormally high lipid and RNA content. When sludges which are acclimated to a high concentration of salt are placed in a fresh water environment, the immediate response involves a release of cellular components indicative of lysis. (Ellis-Texas)
W71-06034

PRELIMINARY PROCESS DESIGN AND TREATABILITY STUDIES OF FISH PROCESSING WASTES,
Quirk, Lawler, and Matusky Engineers. New York.
F. E. Matusky, J. P. Lawler, T. P. Quirk, and E. J. Genetelli.
Proceedings, Industrial Waste Conference, 20t May 4, 5, 6, 1965, Engineering Bulletin of Purd University, Vol XLIX, No 4, p 60-74, July 1965. fig, 9 tab, 3 ref.

Descriptors: *Fish handling facilities, *Fis *Potatoes, Municipal wastes, Waste water trea ment, Digestion, Dewatering, Gases.
Identifiers: Volatile solids.

A combined study of an existing fish plant an treatability of a synthetic waste were used to form rational approach to the process design for a joi plant for the treatment of wastes from domest sewage and fish and chip processing. Determina tion of waste characteristics, an analysis of trea ment unit operations and cost estimates were mad to determine the unknowns and the effect of th proposed processing operations on the joint trea ment system. Laboratory studies on digestion an dewatering were made on a waste-simulatin sludge to determine the optimum digester loadin for a combined fish, potato, and municipal waste (Ellis-Texas)
W71-06035

TREATMENT OF ORGANIC INDUSTRIAL WASTES BY LAGOONING,
California Univ., Berkeley. School of Public Health.
R. C. Cooper, W. J. Oswald, and J. C. Bronson.
Proceedings Industrial Waste Conference, 20th May 4, 5, 6, 1965, Purdue University, Vol XLIX No 4, July 1965, p 351-364. 6 fig, 2 tab, 8 ref.

Descriptors: *Industrial wastes, *Aerobic conditions, *Anaerobic conditions, Oil, Lagoons, Waste water treatment, *Oxidation lagoons.
Identifiers: Facultative conditions, Rendering.

A brief description of anaerobic facultative, and aerobic ponds is presented as a possible means of treatment of most industrial wastes. Oxidation ponds were observed and studied at an animal-rendering plant, a hide curing plant, a petroleum plant, and a chicken farm. From these observations it was apparent that lagooning was successful at treating wastes from these industries. Suggestions for designing lagoons, pilot plants, and seeding are presented. (Ellis-Texas)
W71-06036

TWENTY YEARS OF INDUSTRIAL WASTE TREATMENT,
Purdue Univ., Lafayette, Ind.
D. E. Bloodgood.
Proceedings Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, July 1965, p 182-188.

Descriptors: *Industrial wastes, *Waste water treatment, Dairy industry, Canneries, Oil wastes, Pulp and paper industry, Coal mine wastes, Acid water, *Waste treatment.
Identifiers: Packinghouse wastes, Metal plating, Brewing.

There has been an increase in the attention given to the general subject of water pollution and its abatement but there is not adequate information available on the successful operation of plant scale disposal or recovery operations. Although industry has made great strides in changing its physical environment (processes, use of by-products, and waste treatment processes) it has failed to keep others informed of its progress in meeting the challenges of waste treatment. (Ellis-Texas)
W71-06037

BIOLOGICAL CONCEPTS AND INDUSTRIAL WASTE DISPOSAL PROBLEMS,
Academy of Natural Sciences of Philadelphia, Pa.
J. Cairns, Jr.
Proceedings Industrial Waste Conference, 20th, May 4, 5, 6, 1965, Purdue University, Vol XLIX, No 4, July 1965, p 49-59, 5 fig, 5 ref.

Descriptors: *Microbiology, *Microorganisms, *Bioassay, Environmental effects, Biota, Aquatic environment, *Industrial wastes, *Waste disposal, Waste water treatment.
Identifiers: Biological monitoring.

A discussion is conducted demonstrating that biological data is as easily assessed as chemical data, that biological data may be presented numerically, and that existing biological concepts could furnish information not now provided by any other system of pollution detection. The three basic needs of any waste disposal design system include: (1) a baseline reference study showing the existing preoperation conditions; (2) a continually operative monitoring system to check short-term effects caused by spills, changes in operating procedures, etc; and (3) a predictive system whereby the effects of a waste might be measured before introducing the waste into the stream itself. (Ellis-Texas)
W71-06038

DEVELOPMENT OF DESIGN PARAMETERS FOR INTERSTATE REST AREA SEWAGE TREATMENT SYSTEMS,
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
Leslie B. Stuart.
Master of Science Thesis, Engineering Research Series, August 1970. 90 p, 17 tab, 12 fig, 22 ref, 2 append.

Descriptors: *Sewage treatment, *Waste water treatment, *Aeration, Tennessee, Treatment facilities, *Highways, Organic loading.
Identifiers: *Interstate highway system, Rest areas, Package treatment plants, *Extended aeration, Hydraulic loading.

A research project was conducted to establish design parameters for application to Interstate Rest Area sewage treatment facilities. This study was conducted at the Smith County Rest Area, located on I-40, Tennessee where the sewage treatment system consists of a 20,000 gpd package-type extended aeration plant installed in February 1969 on recommendation of private consultants. The investigation indicates that current design of Interstate Rest Area sewage treatment systems in Tennessee is much too conservative and uneconomical. The results of this study indicate that hydraulic loading is the critical factor in sizing package-type treatment facilities for Interstate Rest Areas. The Smith County plant was designed on the basis of 10.68 gallons per vehicle (gpv) but tests showed that the actual flow is only 5.52 gpv and the organic loading is only 200 mg/l while it was designed for 240 mg/l. (Ellis-Texas)
W71-06040

STUDY OF MUNICIPAL WASTE WATER RECLAMATION,
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
William B. Willard, Jr.
Master of Science Thesis, August 1970. 202 p, 15 tab, 70 fig, 51 ref, 10 append.

Descriptors: *Municipal water, *Municipal wastes, Water reuse, Waste water treatment, Water treatment, Chemical oxygen demand, Turbidity, Tertiary treatment, Tennessee.
Identifiers: Total suspended solids, Cookeville (Tenn).

Research was conducted to determine the feasibility of municipal waste water reclamation by recycling a city's sewage treatment plant effluent through its water treatment plant. A continuous flow, 3.5 gallon/hour model water treatment plant was designed and constructed using common chemical-physical treatment processes such as screening, chemical coagulation, sedimentation, filtration, and chlorination. Samples of the effluent from the Cookeville, Tennessee, Sewage Treatment Plant were passed through the model and analyzed for turbidity, total suspended matter and chemical oxygen demand. A comparison of analyses of samples taken before, during, and after treatment was made to evaluate the effectiveness of this treatment. This experiment revealed that within the parameters tested, turbidity, TSS, and COD waste water recycle is feasible and can result in an aesthetically attractive domestic water supply which meets USPHS standards for turbidity of water. This process should also be considered as a means of tertiary treatment. (Ellis-Texas)
W71-06041

SURVEY OF DESALTING PROCESSES FOR USE IN WASTE WATER TREATMENT,
Oak Ridge National Lab., Tenn.
I. Spiewak.
In: Proceedings 9th Annual Environmental and Water Resources Engineering Conference, June 4-5, 1970, Nashville, Tennessee, Technical Report No 22, Department of Environmental and Water Resources Engineering, Vanderbilt University, p 153-178. 12 fig, 9 tab, 19 ref. Housing and Urban Development Interagency Agreement No IAA-H-3-69.

Descriptors: *Water treatment, *Waste water treatment, *Desalination processes, Distillation, Electrodialysis, Flash distillation, Ion exchange, Membrane processes, Reverse osmosis, Economics, Tertiary treatment, Demineralization.
Identifiers: Dynamic membrane hyperfiltration, Recycle.

Various processes were surveyed to determine feasible methods to prevent mineral buildup when reuse of waste water is necessitated in the future. A resume of a system of processes for water supply and waste water treatment is included along with desalination techniques available such as electrodialysis, reverse osmosis, dynamic membrane hyperfiltration, and distillation. Economic analyses, which compared systems with and without recycle, indicated that although tertiary waste treatments may increase the cost of sewage processing by factors of up to 4 times the overall cost of treatment and water supply need not be increased over 50%. This analysis excludes the cost of water distribution and sewage collection which are about 20c/1000 gals, but including them would make the difference in cost between conventional practice and complete recycle only about 30%. (Ellis-Texas)
W71-06042

DESIGN CRITERIA FOR MUNICIPAL WASTE WATER TREATMENT PLANTS IN TENNESSEE,
Tennessee Dept. of Public Health, Nashville. Div. of Sanitary Engineering.
J. W. Saucier.
In: Proceedings 9th Annual Environmental and Water Resources Engineering Conference, June 4-5, 1970, Nashville, Tennessee, Technical Report No 22, Department of Environmental and Water Resources Engineering, Vanderbilt University, p 111-130.

Descriptors: *Waste water treatment, *Design standards, *Specifications, *Standards, Permits, Industrial wastes, Sewerage, Pumping plants, Sedimentation, Aeration, Activated sludge, Lagoons, Tertiary treatment, *Tennessee, *Municipal water, *Municipal wastes, *Treatment facilities, Design criteria.

The Tennessee Department of Public Health has been assigned the responsibility of general supervision of construction, operation, and maintenance of all public waste water systems in Tennessee. The Department must review and approve all plans and specifications and to provide guidance in this matter 'Guide Lines for Review of Plans and Specifications for Waste water Treatment Facilities,' has been published. A resume of these guidelines is given for the new standards in Tennessee but for more complete information the basic regulation should be consulted. (Ellis-Texas)
W71-06043

ALTERNATIVES FOR THE TREATMENT AND DISPOSAL OF ANIMAL WASTES,
Cornell Univ., Ithaca, N.Y.
R. C. Loehr.
In: Proceedings 9th Annual Environmental and Water Resources Engineering Conference, June 4-5, 1970, Nashville, Tennessee, Technical Report No 22, Department of Environmental and Water Resources Engineering, Vanderbilt University, p 185-198. 2 fig, 2 tab, 10 ref.

Descriptors: *Farm wastes, *Water disposal, *Waste water treatment, Water pollution sources, Nutrients, Dentrification, Aeration, Nitrification, Nitrogen, Phosphorous, Oxidation, Oxidation lagoons, *Waste disposal, Solid wastes, Liquid wastes.
Identifiers: Oxidation ditches.

Confined animal production has caused new environmental problems for agriculture by producing large volumes of liquid and solid wastes for disposal. The excessive nutrients in animal wastes and waste waters have been noted as a cause of current and potential pollution problems. Technical processes are available that can treat these wastes but there is no one process or waste management system that is adequate for all animal operations. Aeration systems such as oxidation ditches underlying cattlebarns are gaining acceptance among livestock producers for ease of waste handling for odor control, and for treatment of this waste. Of the possible methods to reduce the concentration of nitrogen and phosphorous reaching surface and groundwaters from the disposal of animal waste waters, ammonia release, controlled nitrification and dentification, and crop or land management appear the most feasible. (Ellis-Texas)
W71-06044

SETTLING CHARACTERISTICS OF ACTIVATED SLUDGE AT LOW TEMPERATURE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Sherwood Reed.
Available from NTIS as AD-717 239, $3.00 in paper copy, $0.95 in microfiche. CRREL Technical Report 203, Nov 1970. 30 p, 17 fig, 5 tab, 25 ref.
Identifiers: *Sewage, *Arctic regions, Chemical precipitation, Mathematical analysis, Design, *Sewage treatment, *Activated sludge process, *Clarification, Settling.

A series of activated sludge settling tests were observed with particle concentration and temperature as the controlled variables. Based on the experimental data, an equation defining settling velocity in terms of concentration, fluid temperature, and organic loading was developed. Although empirical in nature the equation provides a rational basis for the determination of temperature influence and should have special value for cold regions designs. It was possible to describe the results of other investigations with this equation.
W71-06107

WATER QUALITY MANAGEMENT PROBLEMS IN ARID REGIONS.
Robert S. Kerr Water Research Center, Ada, Okla. Treatment and Control Research Program.
For primary bibliographic entry see Field 05G.
W71-06111

FOAM SEPARATION PROCESSES FROM INDUSTRIAL WASTE TREATMENT: PHENOL, PHOSPHATE, AND HEXAVALENT CHROMIUM,
Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
R. B. Grieves.
Proceedings, Industrial Waste Conference, May 3, 4, 5, 1966, Purdue University, Vol L, No 2, p 192-202, March 1966. 8 fig, 7 ref. US Public Health Service Research Grant No WP 00702-02.

Descriptors: *Foam separation, *Industrial wastes, *Phenols, Phosphates, Hydrogen ion concentration, Surfactants, Waste water treatment, *Chromium, Metals, Inorganic compounds.
Identifiers: *Hexavalent chromium.

A comparison is made of previous studies of the residual ratios obtained from the batch foam separation of phenolate, orthophosphate, and dichromate, including the effects of pH and of the initial surfactant concentration; and the establishment of the feasibility of multicolumn, continuous ion flotation of dichromate for the removal and recovery of hexavalent chromium. Dichromate was shown to be least influenced by pH, and for a given surfactant concentration, considerably better results were achieved than for phenolate or phosphate. Combining several columns in series, multicolumn performances have been calculated including a four-column unit in which a 100 mg/l dichromate feed can be reduced to 3 mg/l, using 422 mg/l of surfactant. The combined collapsed foam stream contains 444 mg/l of dichromate and 1904 mg/l surfactant. (Ellis-Texas)
W71-06194

THE EFFECT OF CLAY MINERALS ON SURFACTANT BIODEGRADABILITY,
Rutgers-The State Univ., New Brunswick, N.J.
R. D. Barbaro, and J. V. Hunter.
Proceedings of the 20th Industrial Waste Conference, May 4, 5, 6, 1965, Engineering Bulletin of Purdue University, Vol XLIX, No 4, p 189-196, July 1965. 3 fig, 2 tab, 11 ref.

Descriptors: *Clays, *Biodegradation, *Surfactants, Bentonite, Degradation, Biology, Adsorption, Enzymes.
Identifiers: Kaolinite.

A study was made to observe the effect of several clay minerals upon the extent of biological degradation of several representative surfactants and to point the direction for further research in this area. The biological utilization of relatively degradable species of the 3 types of surfactants may be inhibited by small quantities of kaolinite and bentonite. The observed effect may be due to the adsorption and inactivation of substrate or enzymes. No significant effect of clay particles upon the utilization of the relatively nondegradable species of the 3 types of surfactants could be shown by this technique. (Ellis-Texas)
W71-06196

CONTROL OF INFILTRATION IN SEWER SYSTEMS-DESIGN AND MAINTENANCE,
Nashville Metropolitan Government and Davidson County, Tenn. Sewerage Services.
R. Harrington.
Proceedings, 8th Annual Environmental and Water Resources Engineering Conference, June 5-6, 1969, Technical Report No 20, Department of Environment and Water Resources Engineering, Vanderbilt University, p 11-17, (1969).

Descriptors: *Infiltration, *Sewers, Sewage disposal, Specifications, Groundwater movement, Soil water movement, Waste water treatment, Design standards, Materials testing.

The City of Nashville and the County of Davidson merged in 1963 and brought about an evolution in the design, construction, and maintenance of sanitary sewers. New specifications were required to upgrade the outdated standards of yesteryear. Modern technology has allowed a great reduction in the infiltration allowed under these new specifications at a reduction in initial cost. A change in pipe material, stone bedding, precast manholes, precast service connections, and improved stopper have reduced the amount of infiltration into the sewerage of this community. (Ellis-Texas)
W71-06197

HYDRAULIC OVERLOADING-FACT OR FICTION,
Resource Consultants, Inc., Nashville, Tenn.
J. C. North, and H. D. Tomlinson.
Proceedings, 8th Annual Environmental and Water Resources Engineering Conference, June 5-6, 1969, Technical Report No 20, Department of Environment and Water Resources Engineering, Vanderbilt University, p 19-32, (1969). 16 ref.

Descriptors: *Waste water treatment, *Water treatment, Industrial wastes, Waste water disposal, Tertiary treatment, Storm runoff.
Identifiers: *Recycle.

The problem of handling present hydraulic overloading cannot be separated from other considerations of public interest involving water supply, domestic waste treatment, industrial waste treatment, and conservation of natural resources. Excessive flow in a sewer system or a waste treatment plant is a factor which often requires large capital outlays to correct and is partially responsible for the projected millions of dollars needed to update the existing systems. Reuse of treated waste waters is becoming more popular and economical. A brief review of the applicability of general reuse concepts is presented. (Ellis-Texas)
W71-06198

SOME FACTORS TO BE CONSIDERED IN THE DESIGN OF WASTE DISPOSAL WELLS,
Geological Survey, Nashville, Tenn., Water Resources Div.
D. R. Rima.
Proceedings, 8th Annual Environmental and Water Resources Engineering Conference, June 5-6, 1969, Technical Report No 20, Department of Environment and Water Resources Engineering, Vanderbilt University, p 119-127, (1969).

Descriptors: *Injection, *Waste water disposal, *Hydrologic properties, Groundwater recharge, Waste water treatment, Geologic formations, Hydraulic properties, Hydraulic gradients.
Identifiers: Hydrodynamic dispersion.

The hydrologic factors most commonly overlooked in the design of waste injection wells are natural hydraulic gradients and hydrodynamic dispersion within the proposed injection zones. Natural hydraulic gradients are known to exist in porous and permeable formations at depths of several thousands of feet beneath the land surface and exert a strong influence on the direction and rate of movement of liquid wastes in injection zones. Hydrodynamic dispersion results from velocity variations in laminar flow through porous media and can greatly expand the spread of contaminants from an injection well because the width of the envelope of dispersion increases in proportion to the distance traveled by the dispersing contaminant. (Ellis-Texas)
W71-06199

CONTROL OF WASTES FROM WATER TREATMENT PLANTS,
Virginia State Water Control Board, Richmond.
A. H. Paessler, and E. R. Sutherland.
Proceedings, 8th Annual Environmental And Water Resources Engineering Conference, June 5-6, 1969, Vanderbilt University, Department of Environmental and Water Resources Engineering, p 137-160, (1969). 19 ref.

Descriptors: *Water treatment, *Waste water treatment, *Waste water disposal, *Treatment facilities, Chemical precipitation, Lagoons, Regulation, Abatement.

A staff survey was made of municipal water treatment plants in order to develop criteria for the design of waste treatment facilities for wastes engendered by water treatment. The least expensive method, and most widely used is simple lagooning. Other methods such as sand drying beds, centrifugation, vacuum filtration, treating in sewage works, dilution, and recalcining are other possibilities f the treatment of this sludge. It is evident that t control of water treatment wastes is not depende on technological breakthroughs or massive mon tary investments, but depends primarily upon t determination of regulatory agencies to abate po lution from this source. (Ellis-Texas)
W71-06200

CASE HISTORIES: IMPROVED ACTIVATE SLUDGE PLANT PERFORMANCE BY OPERA TIONS CONTROL,
Federal Water Pollution Control Administratio Cincinnati, Ohio. Div. of Technical Services.
A. W. West.
Proceedings, 8th Annual Environmental and Wat Resources Engineering Conference, June 5- 1969, Technical Report No 20, Department of En vironmental and Water Resources Engineerin Vanderbilt University, p 161-170, (1969).

Descriptors: *Activated sludge, *Waste wate treatment, Aeration, Biochemical oxygen demand Effluent, Trickling filters.
Identifiers: Suspended solids, Clarifiers.

Tests run on tightly controlled sewage treatmen plants at Sioux Falls, South Dakota and at S Louis, Missouri document the excellent final ef fluent quality that can be produced by presentl available secondary treatment processes. Opera tional results of one plant showed a 99% BOD an SS reduction with readily available, present-da treatment processes and equipment. If consisten effluent excellence is to be expected, the treatmen facility must be properly designed with adequat built-in capacity and flexibility, plant charac teristics must be appropriate to the incoming load and the process must be skillfully controlled b conscientious, qualified operators. (Ellis-Texas)
W71-06201

IMPLICATIONS OF WATER QUALITY LAWS FOR THE FEEDLOT INDUSTRY,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.
W71-06222

ECONOMICS OF COMBINING DISTILLED SEAWATER AND RENOVATED WASTE WATER AS A NEW SOURCE OF MUNICIPAL WATER SUPPLY,
Bechtel Corp., San Francisco, Calif.
For primary bibliographic entry see Field 03A.
W71-06238

METHANOL REQUIREMENT AND TEMPERATURE EFFECTS IN WASTE WATER DENITRIFICATION,
Gulf South Research Inst., New Iberia, La.
Shirish G. Dholakia, James H. Stone, and Harry P. Burchfield.
Copy available from GPO Sup Doc as EPA-WQO Report No 17010 DHT, August 1970, $0.50; microfiche from NTIS as PB-198 221, $0.95. 38 p, 7 fig, 6 tab, 14 ref. EPA-WQO Contract No 14-12-527.

Descriptors: *Dentrification, *Waste water treatment, *Temperature, Dissolved oxygen, Tertiary treatment, Pilot plants, Chemical reactions, *Water reuse, Nutrients, Eutrophication, Ammonia, Nitrates, Nitrites.
Identifiers: *Methanol requirement, Packed column reactor, Suspended growth reaction.

A pilot-scale, denitrifying plant was built using two types of continuous-flow reactors, a packed column and a suspended growth chamber. Dentrification at three temperature regimes and three dissolved oxygen levels was studied as a function of the methanol:NO3-N ratio. The most efficient ratio was usually found to be between 2:1 and 3:1. Effective dentrification at lower temperatures and high

dissolved oxygen required ratios equal to or slightly greater than 3:1.
W71-06246

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS.
Franklin Inst. Research Labs., Philadelphia, Pa.
For primary bibliographic entry see Field 04C.
W71-06253

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS (FIRST QUARTERLY ISSUE).
Franklin Inst. Research Labs., Philadelphia, Pa.
For primary bibliographic entry see Field 04C.
W71-06254

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS (SECOND QUARTERLY ISSUE).
Franklin Institute Research Labs., Philadelphia, Pa.
For primary bibliographic entry see Field 04C.
W71-06255

WASTE REDUCTION IN FOOD CANNING OPERATIONS,
National Canners Association Research Foundation, Berkeley, Calif. Western Research Lab.
Walter A. Mercer, and Walter W. Rose.
Copy available from GPO Sup Doc as I67.13/4:12060 - 08/70, $1.00; microfiche from NTIS as PB-198 231, $0.95. EPA-WQO Report 12060, August 1970. 89 p, 17 tab, 31 fig, 4 append. EPA-WQO Grant WPRD 151-01-68.

Descriptors: *Canneries, *Industrial wastes, *Disinfection, *Screens, *Trickling filters, *Separation techniques, Water pollution control, Waste water treatment.
Identifiers: *pH control, *Peach wastes, Tomato wastes.

Trickling Filter--The effects of hydraulic loading and nutrient addition on soluble B.O.D. removal from fruit waste water were investigated. In 1968, at 1250 gpd/sq ft without nutrient addition, 190 lbs of B.O.D./1000 cu ft/day were removed; with nutrient (anhydrous ammonia) addition, 450 lbs of B.O.D. were removed. At 2200 gpd/sq ft, B.O.D. removal decreased slightly. pH Control--Fruit dumping water was acidified with citric acid and controlled at pH 4.0 or below to inhibit bacterial growth and to extend the use of recirculated water. The daily discharge volume of acidified system was 720 gallons containing 118 lbs of B.O.D.; non-acidified, 26,520 gallons, 170 lbs B.O.D. Air Flotation System--Removal from peach rinse water was 75 to 93 percent at 2700 gpd/sq ft and 1400 gpd/sq ft respectively. A 70 percent removal was maintained at 2300 gpd/sq ft for peach and 1400 gpd/sq ft for tomato waste water. Screens--The maximum capacity of the single (20 mesh) deck was 1000 gpm. Compared to 20 mesh rectangular screen, 48 mesh removed 32.2 percent more solids. For the double deck unit containing a 20 mesh top and 100 mesh bottom, the unit handled 1500 gpm - 1.5 times the single deck unit. (Rose-Nat'l Canners Assoc)
W71-06257

DEVELOPMENT OF NEUTRON ACTIVATION FOR INVESTIGATION OF WATER CLARIFICATION,
Missouri Water Resources Research Center.
Louis Hemphill, and Gary C. Batz.
Available from NTIS as PB-198 235, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, September 1970. 15 p, 3 tab, 2 fig. OWRR Project A-026 MO (1).

Descriptors: *Coagulation, *Flocculation, Neutron activation analysis, Zeta potential, Waste water treatment, *Water purification, Electrophoresis, Clays.

The objective of this research was to determine if activation analysis could be used to investigate coagulation-flocculation reactions. Experimental study of the coagulation-flocculation reaction was developed by preparing clay-water mixtures using montmorillonite and illite clay samples and a standard ionic solution. Samples of the clay material were subjected to neutron activation for various times and neutron flux values. The irradiated clay samples were blended with stable clay materials and subjected to electrophoresis. Results of this study showed that clay minerals can be activated to a high value by thermal neutron irradiation and that the neutron irradiation can be controlled to increase the yield of specific radionuclides. Experimental results also showed that the clay particle migrated as a integral unit particle during electrophoresis.
W71-06265

A RATIONAL APPROACH TO THE DESIGN OF AERATED SEWAGE LAGOONS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Edward F. Pohl.
Available from NTIS as AD-717 241, $3.00 in paper copy, $0.95 in microfiche. Special Report 136, October 1970. 25 p, 9 fig, 4 tab, 27 ref.

Descriptors:
Identifiers: *Sewage, *Arctic regions, Military facilities, Oxygen, Design, *Sewage treatment, Secondary sewage treatment, Lagoons (Ponds), *Activated sludge process, *Biochemical oxygen demand, *Aeration.

The use of aerated lagoons as an economical sewage treatment system is a recently developed concept. Its adaptability to arctic and subarctic environments has been established through test programs in Alaska. This report summarizes current developments and discusses the physical and biochemical parameters which must be considered during design.
W71-06267

SURVEY OF DESALTING PROCESSES FOR USE IN WASTE WATER TREATMENT,
Oak Ridge National Lab., Tenn.
I. Spiewak.
Available from NTIS as ORML-TM-3155, $3.00 in paper copy, $0.95 in microfiche. Report ORNL-TM-3155, September 1970. 30 p, 10 fig, 2 tab, 19 ref. HUD Agreement No IAA-H-3-69.

Descriptors: *Waste water treatment, Water reuse, *Sewage treatment, *Desalination processes, Cost analysis, Costs, Tertiary treatment.

This report is based on one of a series of investigations sponsored by the Department of Housing and Urban Development to determine the benefits which might be gained from urban energy centers. A review is given of processes used for waste water treatment, emphasizing new processes which appear to have potential for combination with desalting. A survey of developmental application of desalting processes to wastes is given. Cost estimates are given for a number of possible systems using desalting to treat effluent from a city of 1 million population. The analysis indicates that, although advanced waste treatments may increase the cost of sewage processing by factors of up to four times, the overall cost of water supply, sewerage and treatment need not be increased over about 30 per cent. It is concluded that desalting is primarily of value in systems which provide reusable product water. Such systems generate waste brines very difficult to dispose of, in many cases, except by distillation to dryness.
W71-06268

RADIATION TREATMENT OF SEWAGE,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
E. A. Newland.
Available from NTIS as AAEC/LIB/BIB-254, $3.00 in paper copy, $0.95 in microfiche. AAEC, LIB, BIB No 254, Sept 1970. 9 p.
Identifiers: *Sewage treatment, *Irradiation, *Bibliographies, Sewage treatment.

Literature was searched for the period 1948-1970 to produce a bibliography of 48 journal citations arranged chronologically by year.
W71-06271

HEARING BY DELAWARE RIVER BASIN COMM'N TO EXPAND THE COMPREHENSIVE PLAN.
For primary bibliographic entry see Field 05G.
W71-06275

LOW-PRESSURE AIR TESTS FOR SEWER LINES,
For primary bibliographic entry see Field 08A.
W71-06299

SCREEN TREATMENT FOR SEWER OVERFLOWS.

Am City, Vol 84, No 3, p 24, Mar 1969.

Descriptors: *Screens, Storm runoff, Overflow, Oregon.
Identifiers: *Runoff treatment, Combined sewers.

An alternative to separation of combined sewers in Portland, Oregon is being tested under a FWPCA grant. The experimental pilot plant includes high-rate, fine-mesh screens which treat overflow that is pumped to the plant during periods of heavy rainfall. Previously, only one-third of the rainy season flow was treated while the remainder was discharged untreated into a receiving stream. A description of the structure and workings of the screen operation is given. Laboratory tests will determine the effectiveness and feasibility of the system.
W71-06333

ISLAND CITY SOLVES TOUGH SEWERAGE PROBLEM.
For primary bibliographic entry see Field 08A.
W71-06346

CONSTRUCTION COST REQUIREMENTS FOR WATER AND WASTE WATER FACILITIES.

Public Works, Vol 98, No 12, p 112-113, Dec 1967.

Descriptors: *Cost analysis, Waste water treatment.
Identifiers: *Waste water facilities.

The Business Defense Services Aministration surveyed 1200 major water utilities in order to predict the construction cost requirements for water and waste water facilities. The forecasted average annual expenditure over the 14-year period (1967-1980) showed a 139% increase over annual amounts for the past 12 years. These expenses result from the need to remedy present defects, to account for depreciation and obsolescence, and to counter the demands of an increasing population. Data included indicating costs required for various types of water supply and waste water utilities in addition to amounts to be spent to combat individual problems can serve to guide manufacturers in planning future construction.
W71-06347

SOME ASPECTS OF SEWAGE TREATMENT AT COVENTRY,
R. W. Brooks, H. V. Lee, and M. J. Price.
Water Pollution Control, Vol 68, No 2, p 129-145, Mar 1969.

Descriptors: *Sewage treatment, *Sludge treatment, *Filtration, Storm runoff.
Identifiers: *Storm sewage, Storm overflows, Sewer hydraulics, Great Britain.

An historical progress report of Coventry involving the sewage treatment outline development, activated sludge treatment, and sand filtration is presented. In the 1960's, the elimination of direct storm overflows and the provision of regional storm sewage balancing stations was initiated. Excess flow would be diverted to tanks at the stations until available capacity could be made in the sewer downstream and pumps then could automatically return the contents of the tanks. In the reply to the discussion following the article the limits for discharges from the storm overflows are presented.
W71-06366

WATER TREATMENT - A GUIDE TO THE TREATMENT OF WATER AND EFFLUENTS PURIFICATION: CHAPTER 13 - INTRODUCTORY: SEWER SYSTEMS--OVERFLOWS-CONSERVANCY,
G. V. James.
The Technical Press Ltd, London, p 247-252, 1966. 1 fig, 5 ref.

Descriptors: *Sewerage, *Flow characteristics, *Sewers, *Overflow, *Weirs, Sewage treatment.
Identifiers: *Storm overflows.

General facts concerning sewage and sewer systems are presented, including explanations of sewage 'strength'; variations in flow; the influence of seasonal and weather changes; and the three types of sewerage systems--combined, partially separate, and entirely separate. The operation of local storm overflows to relieve tributary sewers before they are surcharged is described. The three types of overflows are: the ordinary weir type; the improved weir type with a horizontal iron plate and a vertical deflecting plate directing water to the overflow pipe; and the leaping weir type, the best of the three sewage treatment processes mentioned include: chemical precipitation; use of comminutors; and dilution, bleaching and trenching of cesspoool contents.
W71-06371

ALTERNATIVES TO SEPARATION OF COMBINED SEWERS,
D. H. Waller.
Paper presented at the 21st Annual Meeting of the American Water Works Association, Atlantic Branch, Canadian Section, Oct 8, 1968.

Descriptors: *Pollution abatement, *Application methods, *Separation techniques, Overflow.
Identifiers: Combined sewers.

The drawbacks of separation include high costs, public inconvenience during construction, and the continuing problem of polluted stormwater runoff. Alternative solutions to this pollution problem either reduce pollutants in the overflow or decrease amounts of combined sewage that is overflowed. Pollutants can be eliminated from overflows through storage and treatment methods such as disinfection, screening, sedimentation, filtration, and other overflow devices. Possible procedures for diminishing combined sewage overflows outlined include real-time control of discharge points, storage by use of larger pipes, or increased interceptor and treatment plant capacity. Each locality's circumstances will determine which method or combination of methods will provide the best means for solving its pollution problem.
W71-06374

A RE-EXAMINATION OF THE STORM TANK PROBLEM,
L. S. Escritt.
Water Waste Treat, Vol 12, No 9, p 298-300, Sep/Oct 1969. 1 tab.

Descriptors: *Sewers, *Overflow, *Treatment facilities, *Design, Sewage treatment.
Identifiers: *Storm tank, *Capacity, *Stormwater treatment.

Where sewage works treat flow from catchments which are served by combined or partially-separate sewers, a moderately intense railfall-runoff rate will necessitate passage or storm-tank storage of excess flow. The Royal Commission on Sewage Disposal makes recommendations regarding the handling of such overflows. The author of this paper disputes their statement that storm tanks able to hold one-quarter of the daily dry-weather flow will suffice for storing spill-over from small storms. He notes that a capacity of two days dry-weather flow is often needed to prevent spill-over occurring. Functions of storm tanks and the mathematics of stormwater treatment are described. A suggested design for tanks consists of circular tanks with rotating sludge mechanisms. A formula for calculating the required capacity of a tank to prevent spill-over is included.
W71-06377

THE DISCHARGE OF STORM SEWAGE TO PUBLIC WATERS FROM AREAS OF GROUNDS WHICH ARE ENDANGERED BY OIL, IN CONNECTION WITH THE CLEAN WATER ACT FOR BERLIN,
K. H. Salewski.
Gesunh Ingr, (GEINA5), Vol 87, p 265-266, 1966.

Descriptors: *Legislation, *Surface waters, *Separation techniques.
Identifiers: *Germany, Storm sewage, *Oil separators.

In connection with the legislation for the protection of Berlin surface waters, which prohibits the discharge of oil emulsions, the author discusses the use of oil separators for areas where large volumes of oil are handled and where spillage is washed off into the receiving water by rainfall. These oil separators can be installed in sections along areas likely to be affected before storm sewage enters the receiving waters. Standards for the design of such separators are discussed.
W71-06388

STORM WATER TREATMENT AT CLEVELAND,
George D. Simpson, and Lamont W. Curtis.
J. Water Pollution Control Fed, Vol 41, No 2, Part 1, p 151-168, Feb 1969. Paper from Am Water Works Assoc - 88th Annual Conference, Cleveland, Ohio June 2-7, 1968.

Descriptors: *Watersheds (Basins), *Multiple-purpose projects, *Pressure conduits, *Pumping plants, *Water pollution control, *Chlorination, *Pollution abatement, *Lake Erie, Biological treatment, Reduction (Chemical), Recreation facilities.
Identifiers: *Gravity sewer, *Cleveland, Ohio.

A feasibility study was conducted for the FWPCA of a proposed offshore stabilization-retention basin, for the treatment of various polluting flows now being discharged to Lake Erie. The basin would receive treated effluent flow from the City's Easterly Waste water Treatment Plant, as well as flow from six large combined sewer overflow outfalls, and flow from five polluted streams which drain the service area. The proposed basin would be approximately 900 acres in area, with a mean water depth of 33.5 ft. A shoreline collection system is included to convey flows to two central points for discharge into the basin. The collection system will consist of a combination of gravity and pressure conduits, with two pumping stations. Two basic types of purification processes will take place in the basin. Biological and chemical oxidation will result in reduction of BOD and COD; this process will require an aerobic environment. Sedimentation of fine suspended solids, particularly the activated sludge cell matter in the treatment plant effluent, will require quiescent settling. To meet these two conditions, a two stage basin is contem plated. The first stage will be maintained in aerobi condition by air-lift or mechanical pumping. In th quiescent sedimentation stage, it is expected tha an upper layer of five to ten feet of water will b aerobic, with the remainder of the depth anaerobi The basin will create a sheltered bay at th shoreline, which will be used for boating, fishin and swimming. A small boat marina is contem plated as part of the overall project. The basin wi be provided with facilities for chlorination. Effluen will be discharged at about 8,000 ft. from shore in water depth of approximately 42 ft. The basin ha been found feasible from the standpoint of pollu tion abatement and reduction of bacterial con tamination of the City's beaches resulting from pol luted discharges.
W71-06389

OPTIMIZING WASTE TREATMENT CONTRO SYSTEMS,
Ernest T. Williams, Jr.
Paper presented at the Third Annual National Pol lution Control Conference and Exposition, April 1 3, 1970, San Francisco, California.

Descriptors: *Instrumentation, *Waste treatment *Control systems, *Measurement.

As waste treatment and recovery processes becom more complex and costly, there is increasing reliance upon instrumentation to assume contro responsibility for the most economic and efficien operation. This paper describes the control system normally used on four applications, and discusses what can be done to optimize performance. The use of dissolved oxygen and sludge density mea surement in the activated sludge process is ex plored. The second application is pH neutraliza tion. Feedforward control and the nonlinear con troller have dramatically improved neutralization performance. Improvements are also suggested in the control schemes of chromate waste and cyanide waste treatment processes.
W71-06414

CLEANING OUR ENVIRONMENT-THE CHEMICAL BASIS FOR ACTION: SECTION 2 - THE WATER ENVIRONMENT: MUNICIPAL WASTE WATER TREATMENT.
Subcommittee on Environmental Improvement, Committee on Chemistry and Public Affairs American Chemical Society, p 106-122, 1969. 2 fig, 4 tab.

Descriptors: *Waste water treatment, *Overflow, *Storm runoff, *Flocculation, *Treatment facilities, *Water reuse, Sewage treatment, Storage tanks, Underground storage.
Identifiers: *Combined sewers, *Stormwater quality.

This subsection discusses existing processes, recent advances, and current problems relating to municipal waste water treatment. Urban stormwater problems from combined sewer overflows are explained, and possible solutions presented, such as storing overflow and then passing it to plants for skimming and sedimentation and/or polymeric flocculation treatment. Other means of handling overflows include storage in fully or partially flexible underwater tanks or in underground tunnels with subsequent treatment, chlorination, and filtration aided by ultrasonic energy. One current project is evaluating the use of 1-2-acre ponds to collect stormwater runoff and then treat it for reuse. The following recommendations in the area of municipal waste water treatment were made: (1) more research by biochemists and biologists on sewage treatment, primarily to seek radical innovations based on fundamentals of microbiological processes; (2) research expansion on new methods of handling waste water treatment sludges and on parameters involved in using synthetic polymers and polyelectrolytes to improve flocculation, sedimentation, and conditioning of such sludges; and (3) more systematic studies on urban stormwater

uality to provide a sounder base for evaluating arious means of treatment.
/71-06415

XIDATION DITCH TREATMENT OF SWINE VASTES, SUMMARY REPORT,
linois Univ., Urbana.
. L. Day, D. D. Jones, J. C. Converse, A. H. ensen, and E. L. Hansen.
condensation of this paper is published in gricultural Engineering, Vol 52, No 2, p 71-73. ebruary 1971. Complete report available from SAE, St. Joseph, Mich. 49085. Price is $1.00 per opy. American Society of Agricultural Engineers, aper No. 69-924. 16 p, 1 tab, 9 fig, 24 ref. Bureau Solid Waste Management Research Grant No. C-00245-03, also Reg Res Proj NC-69.

escriptors: *Farm wastes, *Waste water treatent, Hogs, Slurries, Odors, Livestock, Effluents, echanical equipment, Protozoae, Biochemical xygen demand, Chemical oxygen demand, Farm goons, Sludge, Aerobic treatment, Biological eatment, Liquid wastes, Laboratory tests, Design iteria, *Oxidation lagoons.
entifiers: Oxidation ditches, Pasveer oxidation tch, Slotted floor, Livestock buildings, Ciliated otozoan, Swine, Oxygenation capacity, Loading tes, Field tests.

vine wastes research for the three-year period ginning September 1, 1966 is summarized. Upon nding that swine manure could be aerobically eated, a modification of the Pasveer oxidation tch was tested. The in-the-building oxidation tch has proven itself in the field as capable not ly of eliminating objectionable odors from anure pits but of reducing the BOD5 pollutional lue of the waste by about 90 percent. The volatile lids can also be reduced by about 50 percent. ven so, the mixed liquor should not be discharged rectly into a stream. There will, however, be sur-us water and sludge to be disposed of, as with any her waste-treatment system. Operating the ditch th a constant liquid depth and a constant rotor mersion depth is recommended for operator nvenience. This can be done by using an over-w. Having the mixed liquor overflow into an robic lagoon is also in keeping with operator conience and low labor requirements. The lagoon n have a fluctuating depth, so that surplus water d sludge can be removed at a convenient time. he simplest method is by using irrigating equipent. (Christenbury-Iowa State)
71-06442

FFECTS OF SURFACE RUNOFF ON THE EASIBILITY OF MUNICIPAL ADVANCED ASTE TREATMENT,
wa State Univ., Ames. Dept. of Civil Engineering.
obert E. Baumann, and Sheldon Kelman.
gricultural Practices and Water Quality, Iowa ate University Press, Ames, Iowa, 1970, Chapter , p 344-362. 7 fig, 1 tab, 19 ref.

escriptors: *Surface runoff, *Sewage treatment, rtiary treatment, Biochemical oxygen demand, dustrial wastes, Farm wastes, Pollutants, Fertilrs, Nitrogen, Nitrates, Phosphorus, Phosphates, gae, Eutrophication, Water quality, Rivers, Iowa, rn, Discharge, Chlorophyll.
entifiers: Industrial water pollution, Des Moines ver, Packing plants.

e protection of the quality of water in Iowa eams requires that attention be directed at the rious contributors of the significant pollutants. tention is currently being directed at municipal d industrial wastes discharges, since these enter eams through a point source and are easily conlled. All such wastes must be given secondary atment prior to discharge to Iowa's streams. As re stringent treatment requirements are deended in the future, there is some question as to ether nutrient removals from municipal and instrial wastes will be sufficient to protect the eam. This study indicated that during periods of dry weather when light and turbidity conditions are favorable for phytoplankton growth, the principal source of the N and P required to support such growth is derived from municipal and industrial waste water discharges. Removal of N and P from such waste water discharges will help reduce phytoplankton growth. In periods of high stream flow, when turbidity levels are high enough to be unfavorable to phytoplankton growth, runoff from urban and rural lands and channel erosion are probably the principal contributors of N and P to the stream. Removal of N and P from municipal and industrial wastes during these periods will not reduce nutrient levels significantly. Under the latter conditions, tertiary treatment of municipal and industrial wastes will be of less benefit until runoff contributions of N and P are also controlled. (See also W71-05437) (White-Iowa State)
W71-06445

LIQUID HANDLING OF POULTRY MANURE,
Massachusetts Univ., Amherst. Dept. of Agricultural Engineering.
Curtis A. Johnson.
ASAE Paper No NA 64-501. Transactions of the American Society of Agricultural Engineers, Vol 8, p 124-126, 1965. 2 fig, 1 tab, 6 ref.

Descriptors: *Liquid waste, *Order, *Septic tanks, *Water reuse, Farm waste, Sludge disposal, Poultry, Ammonia, Disposal, Design criteria, Cost comparisons, Effluents, Waste water treatment.
Identifiers: *Recycling, Liquid-manure handling, Ammonia odor, Congdon system.

This article describes an integrated system concept for liquid manure handling of waste produced by laying hens in conventional commercial cage units. The bird droppings in this unit collect in 8 inch deep, 44 inch wide troughs formed on original floor with 4 inch thick concrete blocks. The lower end of each sloped trough is closed with a 2 inch x 6 inch board. These boards are removed to empty the troughs into a 24 inch by 24 inch trench running across the end of the building below floor level. This sloping trench empites into a 12 inch diameter plastic pipe which conveys the waste to an underground septic tank. From the third compartment of this three-compartment tank the effluent is pumped back into the laying house to hydraulically clean the troughs beneath the cages. The effluent becomes increasingly concentrated. The effluent is periodically pumped onto forest land and the sludge is 'batch' handled. This manure system provides: (1) Easy manure handling, (2) Few moving parts, (3) Little ammonia odor, (4) Low water usage, (5) Simple manure disposal, (6) Low-cost pit cleaning. (Parker-Iowa State)
W71-06450

AGRICULTURE WASTE RESEARCH NEEDS,
Cloisterdale Farms, Ephrata, Pa.
Glenn H. Herr.
Compost Science, Journal of Waste Recycling, Vol 11, No 5, Sept-Oct 1970, p 8-11. 4 fig.

Descriptors: *Farm waste, *Poultry, *Disposal, *Drying, Odor, Costs, Equipment, Aeration, Lagoons, Irrigation, Waste water treatment.
Identifiers: SHUD, Neighbors.

The author is responsible for disposal of 17,000 plus or minus tons of raw waste annually from a laying hen complex of 360,000 hens. Their problems incidental to poultry 'SHUD' were: first - volume accumulation of shud within houses, second - community relations - odor primarily; danger of soil and water pollution secondarily. Third - ultimate disposal, and, finally fourth - the unknown factor of the possibility of, or the effect of, gas toxicity to the chickens and humans. Some of their attempted and/or considered methods for disposal were the use of: (1) lagoons; (2) irrigation; (3) sewage treatment plant; (4) incineration; (5) burying; (6) hauling and spreading; future consideration: (7) semidrying; (8) possible dehydration - which might lead to: fertilizer products; re-feeding; or some other uses. Their conclusion was that liquid handling would not be the long range answer to their problems. They concluded that some method of dry or semi-dry procedure must develop as their solution and as an industry solution. Mr. Herr describes the system of drying the manure in place and the cost of disposal of the simi-dried (30%) SHUD. (Christenbury-Iowa State)
W71-06452

ANAEROBIC DECOMPOSITION OF SWINE EXCREMENT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
O. E. Cross, and Alvaro Duran.
Nebraska Agricultural Experiment Station Journal Paper No 2531. Transactions of the ASAE, Vol 13, No 3, May 1970, p 320-322. 11 fig, 7 ref.

Descriptors: *Farm wastes, Laboratory tests, *Anaerobic digestion, *Hogs, Anaerobic conditions, Temperature, Sludge, Biochemical oxygen demand, Hydrogen ion concentration, Waste water treatment.
Identifiers: Swine, Loading rates, Volatile solids, Detention times, Digesters.

This paper presents a laboratory analysis on the anaerobic digestion of swine excrement as affected by temperature and loading rate. The tests were run for 15 days. The experiments were conducted using ambient temperatures of 50, 70, and 90 F. at three loading rates. The loading rates were 3.2, 1.6, and 0.8 g. of volatile solids per liter of digester volume per day. Volatile-solids content was determined daily during a 15-day test period. Moisture content, total solids, fixed solids and pH were also determined daily. A 5-day BOD test was performed. None of the experiments reached equilibrium; however, it was possible to detect a tendency of the system to approach equilibrium or to approach failure. The results showed that for a load of 0.8 g. at all temperatures the system indicated success in the digestibility of the organic matter. At a load of 3.2 g. at 70 F and 50 F the system tended toward failure. (Christenbury-Iowa State)
W71-06453

USE ANIMAL MANURE EFFECTIVELY,
Arizona Agricultural Experiment Station, Tucson.
J. L. Abbott.
Agricultural Experiment Station and Cooperative Extension Service Bulletin A-55, The University of Arizona. 3 tab, 1 fig, 6 ref.

Descriptors: *Farm wastes, *Fertilizers, *Rates of application, *Return (Monetary), *Beneficial use, Livestock, Arizona, Feedlots, Disposal, Costs, Salts, Nitrogen, Organic matter, Waste treatment.
Identifiers: Manure, Composting.

This publication discusses some important considerations that should be taken into account concerning the use of animal manure as a fertilizer. A possible $90-per-acre return for a $20-per-acre investment is being overlooked by many Arizona farmers. The cost of applying manure is in the order of $2 to $14 per ton up to a 40 mile haul. The fertilizer value of manure is at least $2 per tone for available N and P. The value of organic matter must account for the balance in cost. The greatest value of manure may result from the indirect effects of the organic matter contribution on the physical condition of the soil and in maintaining the availability of certain soil nutrients. The soluble salts in manure commonly range from 5 to 10 percent on a dry basis. Recommendations for manure are seldom more than 5 tons per acre annually. (Christenbury-Iowa State)
W71-06454

5E. Ultimate Disposal of Wastes

THE PRESENT STATE AND PROSPECTS OF DEVELOPMENT IN RADIOACTIVE WASTE MANAGEMENT IN THE USSR,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
B. S. Kolychev, and V. M. Sedow.
Atomic Energy Review, Vol 5, No 4, p 123-150, 1967. 16 fig, 7 tab, 28 ref.

Descriptors: *Radioactive waste disposal, *Ultimate disposal, *Technology, Nuclear wastes, Costs, Waste storage, Waste disposal, Waste water treatment, Pilot plants, Safety, Nuclear reactors, Radioactive wastes, Waste treatment, Nuclear wastes, Drying.
Identifiers: *USSR, Decontamination, Solidification, Burial, Cementation, Bituminization.

This report summarized different chemical methods of liquid radioactive waste decontamination. Combined liquid and solid waste burial following cementation was put in practice. Waste disposal into deep geological formations is fairly safe and the cost does not exceed 1 ruble per cu meter. Studies are under way on solidification of wastes by drying and bituminization, and on the development of reactor cleaning process using electrophoresis and pre-coated filters. Attention has also been paid to new designs of evaporators, driers, electrodialyzers, centrifuges, filters, and equipment for treatment and burial of radioactive wastes. (Wilde-Wisconsin)
W71-06006

BIOLOGICAL CONCEPTS AND INDUSTRIAL WASTE DISPOSAL PROBLEMS,
Academy of Natural Sciences of Philadelphia, Pa.
For primary bibliographic entry see Field 05D.
W71-06038

CRAGE V CITY OF BUFFALO (DUTY OF CITY TO PROVIDE FOR SEWAGE DISPOSAL).
For primary bibliographic entry see Field 06E.
W71-06170

SOME FACTORS TO BE CONSIDERED IN THE DESIGN OF WASTE DISPOSAL WELLS,
Geological Survey, Nashville, Tenn., Water Resources Div.
For primary bibliographic entry see Field 05D.
W71-06199

SOLID WASTE DEPOSITION AND WATER PROTECTION (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
Von Hans R. Wasmer.
Gas-Wasser-Abwasser, Schweiz Vol 49, No 5, 1969. 2 fig, 4 tab, 5 ref.

Descriptors: *Waste disposal, *Waste treatment, *Waste dumps, Oceans, Landfills, Diffusion, Bacteria.

All of this planet's waste must be deposited or disposed of somewhere. The relationship of air-water-ground waste disposal is discussed. Advantages and disadvantages of landfills, ocean dumping, bacterial treatment and diffusion are considered. (Ensign-PAI)
W71-06210

A FEASIBILITY ANALYSIS OF INCINERATOR SYSTEMS FOR RESTORATION OF OIL CONTAMINATED BEACHES,
Envirogenics Co., El Monte, Calif. Division of Aerojet General Corporation.
R. M. Roberts, and J. S. Hoyt.
Copy available from GPO Sup Doc as I 67, 13/4, 15080 DXE 11/70, $0.75, microfiche from NTIS as PB-198 227, $0.95. EPA-WQO Report 15080 DXE, November 1970. 73 p, 16 fig, 10 tab, 37 ref. EPA-WQO Contract 14-12-595.

Descriptors: *Beaches, *Oil wastes, *Cleaning, Shore Protection, Shores, Coasts, Incineration, Oily water, Disposal, Wastes, Burning.
Identifiers: *Oil spills, *Beach decontamination.

The feasibility of employing a combustion effect for restoring oil contaminated beaches was investigated. Beach access problems and the handling characteristics of shore materials limited the potential application to recreational (sand) sites. Thermodynamic arguments required that a system design be adopted in which the contaminated sand would undergo combustive processing in a confined arrangement. The design selected, from those analyzed, proved to be a three-effect combustor based on the rotary kiln principle. Provided that the sand to be cleaned is carefully enough collected to furnish a reasonable (greater than or equal to 6%) oil content and is moved away from the surf and drained to an acceptable moisture level (less than or equal to 6%) processing costs would be highly attractive. In comparison with uncontaminated sand, the cleaned product exhibits only a slightly greyish hue.
W71-06252

AERIAL PHOTOGRAPHIC TRACING OF PULP MILL EFFLUENT IN MARINE WATERS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-06258

ULTIMATE DISPOSAL OF INDUSTRIAL WASTE: AN OVERVIEW,
Advanced Waste Research Program, Cincinnati, Ohio.
Robert B. Dean.
Technology Review, Vol 73, No 5, p 20-25, March 1971.

Descriptors: *Ultimate disposal, *Waste disposal, *Sludge disposal, *Brine disposal, *Land reclamation, Deep wells, Oily water, Food chains.
Identifiers: *Ocean disposal, Waste recovery.

Some industrial wastes can be reused, but by no means all, so the task of final disposal remains with us. This article surveys the routes that are available: their capabilities and limitations for particular chemical classes of waste substances. (Dean-EPA/WQO)
W71-06259

MARINE WASTE DISPOSAL AND SEA URCHIN ECOLOGY,
California Inst. of Tech, Pasadena.
For primary bibliographic entry see Field 05C.
W71-06262

STATE BOARD OF HEALTH (DISPOSAL OF SEWAGE AND SOLID WASTES).
For primary bibliographic entry see Field 06E.
W71-06278

OXIDATION DITCH TREATMENT OF SWINE WASTES, SUMMARY REPORT,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 05D.
W71-06442

5F. Water Treatment and Quality Alteration

WATER AND MAN'S HEALTH,
Agency for International Development, Washington, D.C. Office of Human Resources and Social Development
Arthur P. Miller.
Available from NTIS as PB-196 350, $3.00 paper copy, $0.95 in microfiche. AID Commu Water Supply Technical Series No 5, July 1 (Reprint). 92 p, 252 ref.
Identifiers: *Water pollution, *Public hea *Water resources, Public health, Diseases, In tious diseases, Parasites, Water quality, W supply, Radioactive wastes, Water consumpt Chemical compounds, Contaminants, W chemistry, Toxicity, Humans, Water treatm Mortality.

Introductory sections of this booklet discuss the portance of water to human beings. Other secti consider parasites and water, relationship of w to other diseases and to chemical substances ticularly radioactive materials.
W71-06108

ALGICIDES,
Wisconsin Univ., Madison. Water Resour Center.
For primary bibliographic entry see Field 05C.
W71-06189

DEVELOPMENT OF NEUTRON ACTIVATI FOR INVESTIGATION OF WATER CLARI CATION,
Missouri Water Resources Research Center.
For primary bibliographic entry see Field 05D.
W71-06265

THE WRAY FLOOD DISASTER AND ITS E FECTS ON THE PUBLIC HEALTH SERVICES
D. H. Maud.
Inst Public Health Engrs. Vol 67, Part 4, p 244-2 Oct 1968.

Descriptors: *Storm runoff, *Outlets, *Bypass Sewage treatment, Repairing, Sewage.

Intense thunderstorms and flooding damaged t water supply system and sewerage and sewa disposal systems of the town of Wray on the ri Roeburn. As a result of the storm, the outlet pi which allowed storm water overflow to pass to t river, was completely filled with silt as were oth parts of the sewage disposal system. In addition repairs on the sewer disposal and sewerage syste town workers cleared the outfall pipe, th establishing a bypass to the river. They then co nected the washout valve on the filter feedline ne the dosing chamber to the humus tanks. By r opening the inlet valve to the primary sediment tion tank and opening the dosing chambe washout, primary tank effluent was routed to t humus tanks; and thus, a two-stage settleme treatment system was instituted in place discharging raw sewage over the side weir stor overflow.
W71-06386

5G. Water Quality Control

REMOVAL OF CONTAMINANTS FROM LAK ONTARIO BY NATURAL PROCESSES,
Canadian Oceanographic Data Centre, Ottaw (Ontario).
H. E. Sweers.
In: Proceedings Twelfth Conference on Gre Lakes Research, May 5-7, 1969, University Michigan, Ann Arbor: International Associatio for Great Lakes Research, p 734-741, 1969. 8 p, fig, 7 ref.

Descriptors: *Self-purification, *Water pollutio control, *Lake Ontario, *Water circulation, Pat of pollutants, Nutrients, Algae, Stratified flow Mixing, Flow, Model studies, Mathematica models, Great Lakes, Thermal stratification.
Identifiers: Removal time (Pollutants).

A model is developed to calculate the removal tim of a conservative contaminant from a lake, takin summer stratification into account. The basic as

sumptions of the model were compared with conditions actually occurring in Lake Ontario, and it is shown that stratification has little effect on the calculated removal time. The results are extrapolated to the behavior of non-conservative parameters. A sharp reduction in the rate of input of nutrients could result in a marked decrease in algal growth within a year after such measures become effective. (See also W71-05561) (Knapp-USGS)
W71-05878

ORGANIZING WATER POLLUTION CONTROL: THE SCOPE AND STRUCTURE OF RIVER BASIN AUTHORITIES,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06F.
W71-05936

WATER POLLUTION CONTROL, RIVER BASIN AUTHORITIES AND ECONOMIC INCENTIVES: SOME CURRENT POLICY ISSUES,
Bowdoin Coll., Brunswick, Maine; and Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B.
W71-05937

OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Arlington, Va.
For primary bibliographic entry see Field 06B.
W71-05938

A MODEL OF PUBLIC DECISIONS ILLUSTRATED BY A WATER POLLUTION POLICY PROBLEM,
Resources for the Future Inc., Washington, D.C.
For primary bibliographic entry see Field 06A.
W71-05939

5 YEARS OF IMPROVEMENT IN WATER SUPPLY QUALITY,
American Water Works Association, New York.
For primary bibliographic entry see Field 06E.
W71-05943

URBAN PLANNING ASPECTS OF WATER POLLUTION CONTROL,
Columbia Univ., New York.
For primary bibliographic entry see Field 06B.
W71-05944

PESTICIDE RESIDUES AND ENVIRONMENTAL ECONOMICS,
Florida Univ., Gainesville; and Missouri Univ., Columbia.
W. F. Edwards, Max R. Langham, and J. C. Headley.
Natural Resources Journal, Vol 10, No 4, p 719-731, October 1970.

Descriptors: *Pesticide residues, Cost-benefit analysis, Social welfare, Regression analysis, Marginal cost, Marginal value, Productivity.
Identifiers: *Environmental economics, Externalities, Objective function, Property rights, Consumer surplus, Producer surplus.

The relationship between externalities and public policy in environmental quality management are considered. Disputes created by externalities can be settled through participatory decision-making but policy decisions reached in this way do not represent social costs and benefits precisely. If social costs and benefits are the major determinants of public policy then better measures of social welfare are necessary. The author presents two studies which provide empirical measures for pesticide policy-making. The first study measures the productivity of pesticides for U.S. agriculture as a whole. The second study tries to include externalities in a policy decision model to determine which of two pesticide policies is optimal from a social welfare point of view. The measure of social welfare used in this study consisted of consumers' surplus plus producers' surplus modified for externalities. This model is capable of including reduction in both air and water quality and is relevant to water studies concerned with the role of non-market effects in water quality management. (Siegenthaler-Rutgers)
W71-05951

THE ROLE OF INCENTIVES, PENALTIES, AND REWARDS IN ATTAINING EFFECTIVE POLICY,
Brookings Institution, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-05959

O'HEARN V TOWN OF ADAMS (DAMAGES FOR OVERFLOW OF SEWAGE).
For primary bibliographic entry see Field 06E.
W71-05967

ALDRIN: REMOVAL FROM LAKE WATER BY FLOCCULENT BACTERIA,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
Walter O. Leshniowsky, Patrick R. Dugan, Robert M. Pfister, James I. Frea, and Chester I. Randles.
American Association for the Advancement of Science, Vol 169, p 993-995, 1970. 1 fig, 22 ref.

Descriptors: *Aldrin, *Chlorinated hydrocarbon pesticide, *Flocculation, *Bacteria, Lake Erie, Adsorption, Colloids, Sediments, Diatoms, Detritus, Suspended load, Insecticides, Silts, Pesticides, Lakes.
Identifiers: *Floc forming bacteria, Inorganic particles, Microparticulates, Flavobacterium, Protaminobacter, Bacillus.

Studies of chlorinated hydrocarbon insecticides in a water column indicated that floc-forming bacteria isolated from Lake Erie adsorb and concentrate aldrin from colloidal dispersion and the subsequent settling of the bacterial flocs remove aldrin from the water phase. One bacterium was an orange-red pigmented gram-negative rod, tentatively identified as either a Flavobacterium or Protaminobacter. The other was a gram-positive species of Bacillus. Gram-negative bacteria adsorption is slower as compared to the gram-positive, with considerable concentrating effect. Contemporary sediments forming in Lake Erie contain aldrin and could adsorb more. The presence of both aldrin and dieldrin was detected by both gas chromatography and microcoulometry. Electron microscopic examination of Lake Erie contemporary sediments show that these sediments consist of a conglomerate floc of bacteria, diatoms, and inorganic and detrital particles. Flocculent bacteria also adsorb microparticulates, and this adsorption capacity represents a mechanism for sediment formation, and for the removal of suspended particles including aldrin from the water column. (Jones-Wisconsin)
W71-06000

JAMAICA BAY AND KENNEDY AIRPORT: A MULTIDISCIPLINARY ENVIRONMENTAL STUDY.
Jamaica Bay Environmental Study Group, N.Y.
For primary bibliographic entry see Field 06G.
W71-06045

WATER POLLUTION: OBSERVATIONS ON CONNECTICUT'S RESPONSE,
Edward W. Manasse, and Edward Kiel.
Connecticut Law Review, Vol 3, No 1, p 206-224, 1970. 19 p, 82 ref.

Descriptors: *Connecticut, *Pollution abatement, *Water quality control, *Legislation, Water pollution control, Massachusetts, Colorado, Pennsylvania, Water conservation, Water resources, Impaired water quality, Financing, Cost sharing, Damages, Remedies, Industrial wastes, Municipal wastes, Public health, State governments, Local governments, Administrative agencies, Judicial decisions, Legal aspects.

In order to assess the Connecticut Clean Waters Act of 1967, this article compares it with the traditional common law response to the pollution problem, the Massachusetts approach, and the legislative answers preferred by Colorado and Pennsylvania. It is concluded that these other approaches to the problem are inadequate in that they are compatible with continued pollution of water, lack sufficient sanctioning power, and lack provision for funding of pollution abatement. The Clean Waters Act is a model for the achievement of successful pollution abatement. The future of water resources in Connecticut has been given a large thrust forward, due in large part to: the newly created enforcement methods, the threat of potentially severe economic penalties, and the ability to order corrective action to abate what may appear to be a possible future source of pollution. An evaluation of the effect and future potential of the Act at the actual operating level is made. The Water Resources Commission has been active in its supervision of water pollution abatement. If its present level of activity is maintained, Connecticut may conceivably have clean waters by its target date of 1974. (Smiljanich-Florida)
W71-06047

THE ENVIRONMENTAL LAWSUIT: TRADITIONAL DOCTRINES AND EVOLVING THEORIES TO CONTROL POLLUTION,
Robert R. Lohrmann.
Wayne Law Review, Vol 16, No 3, p 1085-1135, 1970. 51 p, 270 ref.

Descriptors: *Water pollution control, *Pollution abatement, *Legal aspects, *Remedies, Judicial decisions, Legislation, Environment, Ecology, Legal aspects, Administration, Federal government, State governments, Governments, Regulation, Environmental effects, Environmental sanitation, Balance of nature, Natural resources, Federal jurisdiction, State jurisdication, Political aspects, Adjudication procedure.
Identifiers: Constitutional aspects.

Dealing with environmental lawsuits in general, this article first examines the procedural considerations involved, including: standing to sue in the federal and state courts, class actions, and burden of proof. Next, tort remedies are considered and compared to determine their ultimate values in environmental litigation. These include: nuisance, both public and private; trespass; strict liability; and negligence. The public trust doctrine is examined to determine its possible use in environmental lawsuits. Statutory rights created by both federal and state legislation are interpreted and evaluated. Constitutional rights to a healthful environment are examined in light of certain recent state constitutional provisions, as well as those already existing as penumbral rights under the United States Constitution. The author contends that environmental lawsuits play two significant roles: (1) the development of a body of case law which will indicate to legislators the areas of concern and the legal issues, and (2) the regulation of localized pollution. (Robinson-Florida)
W71-06048

CONTROL OF RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT.
Atomic Energy Commission, Washington, D.C.

Federal Register, Vol 35, No 63, Wednesday, April 1, 1970, p 5414-5416.

Descriptors: *Radioactive wastes, *Nuclear reactors, *Nuclear powerplants, *Administrative agencies, Federal government, Industrial wastes, Radiation, Public health, Environmental effects, Hazards, Water pollution sources, Nuclear energy,

Electric power industry, Electric power production, Nuclear wastes, Waste treatment, Waste water treatment, Treatment facilities, Effluents, Waste water (Pollution), Institutional constraints, Regulation, Adoption of practices, Permits.
Identifiers: *Administrative regulations.

In these proposed amendments to existing regulations, the Atomic Energy Commission would require licensees to maintain radiation levels below specified standards. Persons engaged in licensed activities would be required to make every reasonable effort to keep radiation exposure and effluent release in unrestricted areas as far below specified limits as practicable. Applicants for licenses must identify the design objectives and the means to be employed to keep radioactive effluent material as low as possible. Light-water-cooled power reactor licenses will include specifications requiring adherence to effluent-control procedures and the maintenance and use of waste treatment equipment. Semiannual reports detailing the quantity of radioactive material released would be filed and after compilation released to the public. In proposing these amendments the Commission notes that: (1) AEC standards are based on Federal Radiation Council guidelines; (2) an increase in the size and number of reactors may be expected; (3) there is a recognized need for flexibility in the operation of nuclear plants; (4) monitoring activities continue to be important; and (5) research and development by the nuclear power industry will continue to be encouraged. (Earl-Florida)
W71-06051

VIEWS OF THE GOVERNORS ON TAX INCENTIVES AND EFFLUENT CHARGES (WATER POLLUTION CONTROL AND ABATEMENT).

House Comm on Government Operations, H Rep No 1330, 89th Cong, 2d Sess 1966. 75 p.

Descriptors: *Pollution abatement, *Industries, *Federal government, *State governments, Water pollution, Water pollution control, Public health, Water quality, Taxes, Effluents, Sewage effluents, Legal aspects.
Identifiers: *Tax incentives, *Effluent charges.

The House Committee on Government Operations conducted a study to determine methods for preventing and controlling water pollution. The views of the nation's state governors were solicited to determine the efficacy of tax incentives and effluent charges to achieve pollution abatement. The report reaches several conclusions. Tax incentives to encourage pollution abatement are not extensively used by the states although legislation in the area is being considered. Prior experience indicates that industry frequently fails to utilize tax incentive programs for pollution abatement. Most states support federal tax incentive programs for pollution abatement, and no conflict between such a federal program and similar state programs was observed. However, those opposing tax incentives suggested that industry should not be paid for complying with pollution law. No state currently utilizes effluent charges to control pollution. Most governors opposed federal effluent charges as a license to pollute and because of anticipated difficulty in administration. (Hart-Florida)
W71-06052

WATER POLLUTION PROBLEMS AND CONTROL PROGRAMS IN MICHIGAN'S PORTION OF THE GREAT LAKES.
Michigan Water Resources Commission, Lansing.

Excerpted from Clean Water It's up to you. Typescript, 10 p

Descriptors: *Michigan, *Great Lakes, *Water pollution control, *Water pollution sources, Water quality control, Water resources development, Pollution abatement, Lake Erie, Lake Huron, Lake Michigan, Lake Superior, Waste treatment, Administrative agencies, State governments, Federal government, Thermal pollution, Storm runoff, Oil, Ships, Irrigation effects, Runoff, Acid mine water, Sediments, Estuarine environment, Eutrophication.

A survey of water quality conditions of the Great Lakes surrounding Michigan shows that the lakes are of high quality and relatively unpolluted, with the exception of Lake Erie and portions of Lake Michigan. The Michigan Water Resources Commission is effective in anti-pollution efforts, especially through voluntary pollution abatement. The Commission specifies restrictions on waste discharges, and a deadline is established for meeting these limitations. Where voluntary compliance is ineffective, the Commission does not hesitate in seeking court action or pursuing the penalty provisions of the law. A survey is made of various enforcement conferences called by the Secretary of the Interior. The top priority pollution problems requiring development of improved control techniques include: (1) thermal pollution from power plants and industry; (2) storm water overflows which bypass sewage treatment plants; (3) oil spills; (4) vessel pollution in harbors and heavily used waterways; (5) irrigation pollution resulting in concentrated salts and minerals; (6) agricultural runoff; (7) acid mine drainage; (8) increase in sediment volumes; (9) destruction of estuaries by pollution, dredging, and filling; and (10) eutrophication by addition of excessive nutrients. A brief survey of waste treatment methods is included. (Smiljanich-Florida)
W71-06053

WATER QUALITY STANDARDS.
Department of the Interior, Washington, D.C.

Code of Federal Regulations, Title 18, Chap V, part 620, 1970. 10 p.

Descriptors: *Water quality control, *Standards, *State governments, *Pollution abatement, Water Quality Act, Water pollution control, Federal government, Administrative agencies, Regulation, Administration, Water policy, Adoption of practices, Legal aspects, Legislation, Public health, District of Columbia, United States, Water resources development, Governments, Federal jurisdiction.
Identifiers: *Federal Water Pollution Control Act.

Pursuant to the Federal Water Pollution Control Act, the Secretary of the Interior herein identifies and describes those state-adopted water quality standards which meet the criteria of the federal act. The water quality standards consist of state water quality criteria and a plan for the enforcement and implementation of such criteria. The Secretary must determine if such standards will protect the public health or welfare, enhance the quality of water and serve the purposes of the federal act. The standards thus qualifying are available for inspection at offices of the Federal Water Pollution Control Administration. Each state, plus the District of Columbia and territories of the United States, is listed with reference to its approved water quality standards. (Smiljanich-Florida)
W71-06054

THE ENFORCEMENT PHASE OF POLLUTION ABATEMENT: THE ROLE OF THE ARMY ENGINEERS,
Gunnar K. Mykland.
Water and Sewage Works, Vol 117, No 6, p 213-216, June 1970.

Descriptors: *Pollution abatement, *Water pollution, *Administrative agencies, *Water pollution control, Legislation, Legal aspects, Judicial decisions, Rivers and Harbors Act, Water Quality Act, Federal government, Administrative decisions, Governments, Administration, Regulation, Abatement, Non-structural alternatives.

The Army Corps of Engineers has primary responsibility for enforcement of federal anti-pollution legislation. During 1969, the Corps of Engineers reported an average of one violation per day to the Department of Justice for prosecution. The various examples of older legislation utilized to abate pollution are discussed in this article, including the Rivers and Harbors Act and the Oil Pollution Act of 1924. It is observed that the primary object of the earlier legislation was to protect navigation from obstruction and injury, and hence enforcement was focused on this purpose. Conversely, the article observes that present enforcement emphasizes protection of the general public interest rather than protection of navigation. Two problems of enforcement are: (1) difficulty in securing sufficient evidence to justify prosecution; and (2) insufficient personnel to police the numerous and widely dispersed areas. Pollution abatement is said to depend upon increased public concern and familiarization with available legislation. Recent legislation examined includes: (1) the Oil Pollution Act of 1961; (2) the Fish and Wildlife Coordination Act; (3) the National Environmental Policy Act; and (4) the Water Quality Improvement Act. A number of landmark court decisions are also noted. (Hart-Florida)
W71-06055

SIMULATION OF A WATER RESOURCE SYSTEM, FINAL REPORT,
Washington Univ., Seattle. Fisheries Research Inst.
William H. Lenarz.
University of Washington Fisheries Research Institute, February 5, 1969. 10 p, 1 fig, 11 refs. OWRR Project A-003-Wash (1).

Descriptors: *Model studies, *Computer models, *Abstracts, *Computer programs, Sampling, Data collection, Data processing, River forecasting, Anadromous fish, Salmon, River flow, Zooplankton, Fish management, Fish harvest, Washington.
Identifiers: Green-Duwamish Rivers of Washington, Duwamish Estuary of Washington, Elliott Bay of Washington.

Computer analysis and modeling using field data from automatic water-quality monitors was tested and found to provide sufficient information for evaluation of general trends affecting fish populations, such as dissolved oxygen, temperature, and pH. Other projects were undertaken for which data was collected and analyzed and computer programs written. A series of models, simulating population dynamics in freshwater zooplankton, analysis of problems of determining maximum sustained yield of a mixture of fish stocks, a simulation of anadromous fish migration, and a simulated river flow model for which a flow diagram is given, were developed. The Green-Duwamish Rivers and the Duwamish Estuary-Elliott Bay area were used in the model studies. A list of publications resulting from this research is appended to the report. (Yensen - Arizona)
W71-06066

WATER QUALITY TELEMETRY FINAL PROGRESS REPORT,
Utah Water Research Lab., Logan.
Durad S. Woffinden, and Allen D. Kartchner.
Utah Water Research Laboratory Report PRWG 3-2 College of Engineering, Utah State University, August 1969. 42 p, 29 fig, 2 tab. FWPCA Grant No WPD 179-02-68.

Descriptors: *Water quality control, *Telemetry, *Remote sensing, *Design, *Engineering, Water measurement, Data collections, Data transmission, Sampling, Instrumentation, Electronic equipment, Construction costs, Cost analysis, Analytical techniques, Methodology, Water properties.

A battery-powered radio-telemetry method for monitoring water quality has been developed by the Utah Water Research Laboratory. Overcoming the major difficulty of large, unwieldy size, the Utah Water Research Laboratory's unit is small enough to be hand-carried, being housed in a 15 in. x 15 in. x 14 in. fiberglass case. Photographs illustrate the unit. A technical description is given, in-

cluding circuitry, block diagrams of the field station and base station, transmitter receiver control and power interconnections, timer operation, and station reply techniques. Measurements of dissolved oxygen, temperature, pH, and conductivity can be made automatically, and the circuits for each of these measuring devices are outlined. A table analyzes costs of both field and base stations, including assembly time and labor costs. (Yensen - Arizona)
W71-06069

ONE-DIMENSIONAL OPEN CHANNEL HEAT DISPERSION,
Tennessee Univ., Knoxville.
David Chung-Shung Chou.
MS Thesis, University of Tennessee, June 1969. 53 p, 35 ref, 6 tab, 7 fig.

Descriptors: *Dispersion, *Heat transfer, *Temperature, *Mathematical models, Hydraulic models, Energy transfer, Convection, Diffusion, Mixing, Water pollution, Channel flow, Open channel flow, Hydraulics.
Identifiers: Heat dispersion modeling, Heat dispersion coefficients.

A one-dimensional mathematical model which describes the turbulent mixing process under steady uniform flow conditions has been developed for predicting the longitudinal heat dispersion coefficient in a laboratory flume. Heated water was used as the tracer in these experiments. It was found that a solution to the general dispersion equation is applicable to describe the turbulent mixing process involved with heat dispersion for a one-dimensional open channel flow. A set of heat dispersion coefficients in the laboratory flume was obtained under five different uniform steady flow conditions. The experimental results showed that the longitudinal heat dispersion coefficient, DL, increases the depth of flow decrease. (Novotny-Vanderbilt)
W71-06085

COOLING WATER RESOURCES AND POWER GENERATION,
Southern California Edison Co., Los Angeles.
J. R. Laverty, and P. J. West.
Presented at National Water Resource Conference, ASCE, Phoenix, Arizona, January 1971. Typescript, 21 p.

Descriptors: *Cooling water, *Thermal powerplants, Thermal pollution, Temperature, California, Thermal power, Electric power, Electric power industry, Cooling, Water resources, Colorado River, Water supply.

Sources of cooling water are the ocean, reclaimed waste water, and fresh water. The problems connected with the use of water from these sources are discussed, based on trends in power generation needs in the future. Different cooling systems in steam power plants are described (once-through cooling, evaporative cooling towers, ponds, etc.). In southern California, a particular attention has to be paid to the fresh water cooling resources, and problems connected with it are discussed in the paper. It has been predicted by Edison Company that the cooling water demand by the company will be 70 times greater in the year 2010 than in 1970. It has been found that the water will have to be imported from other regions in order to satisfy such great amounts of cooling water. Also, the future powerplants will have to be located outside of southern California. The sea water is also considered as a main future cooling water resource. (Novotny-Vanderbilt)
W71-06091

STUDY OF THE BEHAVIOR OF OIL SPILLS IN THE ARCTIC,
Coast Guard, Washington, D.C. Applied Technology Div.
For primary bibliographic entry see Field 05B.
W71-06101

STUDY OF EQUIPMENT AND METHODS FOR REMOVING OR DISPERSING OIL FROM OPEN WATERS,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
C. H. Henager, P. C. Walkup, J. R. Blacklaw, J. D. Smith, and L. M. Polentz.
Available from NTIS as AD-716 792, $3.00 in paper copy, $0.95 in microfiche. Report No CR71-001, August 1970. 239 p, 47 fig, 15 tab, 50 ref. Navy Contract N62399-70-C-0008.
Identifiers: *Water pollution, *Oils, Costs, Petroleum, Removal, Combustion, Toxicity, Oceans, Lakes, *Oil pollution, *Water pollution control, *Water pollution control equipment, Skimmers, Booms equipment, *Dispersants, *Emulsification.

A cost effectiveness analysis was performed for equipment, materials and techniques applicable to the removal or dispersal of spilled oil from U.S. Navy AO and AOG vessels on open waters. Effectiveness parameters included oil product types (JP-5, Distillate Fuel, Navy Special and Bunker C), expected spill locations (3 and 12 miles from shore) and size of expected spill (10 tons, 1000 tons and 25,000 tons). Criteria for evaluation of systems under the above parameter situations, formulated for presently available equipment and materials, include: completeness of oil removal; rate of removal; hazard and pollution; use in limited access areas; sensitivity to expected environmental factors; sensitivity to temperature extremes; toxicity to marine life and system avilability. Cost effectiveness was determined using the 3 spill sizes and checked for spill frequency. The three most cost effective systems for the spectrum of spill sizes were found to be burning of the oil, dispersing the spilled oil and mechanical skimming. Considering system applicability to various products and the practical requirements of rate of removal for massive spills, the most practical universal system with a favorable cost effectiveness ratio was found to be dispersing. This is followed by dispersing plus a containment boom. Burning agents applied directly to the spill was judged to the third system based on its favorable cost effectiveness but limited applicability to oil types and permissible burning circumstances.
W71-06106

WATER QUALITY MANAGEMENT PROBLEMS IN ARID REGIONS.
Robert S. Kerr Water Research Center, Ada, Okla. Treatment and Control Research Program.

Available from NTIS as PB-198 125, $3.00 in paper copy, $0.95 in microfiche. James P. Law, Jr., and Jack L. Witherow, Editors. Federal Water Quality Administration Water Pollution Control Research Series 13030 DYY 6/69, October 1970. 105 p. FWQA Program 13030 DYY.

Descriptors: *Conferences, *Water quality, *Water pollution sources, *Water pollution control, *Arid lands, Irrigation, Agriculture, Evaporation, Salinity, Farm wastes, Surface waters, Groundwater, Planning, Irrigation effects, Wastes, Nutrients.

An international conference entitled 'Arid Lands in a Changing World' sponsored by the American Association for the Advancement of Science Committee on Arid Lands and the University of Arizona, was held at Tucson in June, 1969. The Federal Water Quality Administration provided financial support for the conference and solicited papers to be presented in the Water Management and Salinity and Desalinization sessions. This report presents a selected group of the papers presented at those sessions which should benefit those concerned with water quality management problems in arid regions. The title of the papers included in this report are as follows: nitrate removal from agricultural waste water; the effects of salinity standards on irrigated agriculture in the Colorado River basin; problems of pollution of irrigation waters in arid regions; water quality requirements and re-use of waste water effluents; salinity control in return flow from irrigated areas--a demonstration project; water quality control problems in inland sinks; natural pollution in arid land waters; distillation of waste waters: a water resource for arid regions; and animal waste runoff--a major water quality challenge. (See also W71-06112 thru W71-06114) (Woodard-USGS)
W71-06111

FRONTIERS IN CONSERVATION.
For primary bibliographic entry see Field 04C.
W71-06129

WATER QUALITY MODELING AND PREDICTION,
Kansas Water Resources Research Inst., Manhattan.
E. S. Lee, L. E. Erickson, and L. T. Fan.
Available from NTIS as PB-198 127, $3.00 in paper copy, $0.95 in microfiche. KWRRI, Kansas Water Resource Research Institute, Contribution No 52, January 1971. 78 p, 9 tab, 21 fig, 24 ref, append. OWRR Project B-015-KAN (2).

Descriptors: Biochemical oxygen demand, *Water quality control, *Model studies, *Forecasting, Mathematical models, Water pollution control, Dispersion, Dissolved oxygen.
Identifiers: Parameter estimation, Axial dispersion, Quasilinearization, Invariant imbedding, Nonlinear filtering.

The recently developed modeling and forecasting techniques such as quasilinearization and invariant imbedding are applied to the modeling of water quality systems. Due to the fast convergence rate and the sequential nature of the estimation scheme, a large amount of computer time and computer memory can be saved. Furthermore, these approaches form an effective forecasting technique for the prediction of pollutant concentration. The dispersion model with the consideration of axial mixing is used. By properly adjusting the axial diffusion coefficient, the dispersion model can represent streams with any degree of mixing. A water stream with intermediate reservoirs, and with waste discharges and water intakes along the stream, is represented by a system of second order differential equations. These equations are obtained by dividing the stream into different segments. An analytical solution is obtained for this system of equations to predict the BOD and DO concentrations. Based on this model, simulation study is also carried out to investigate the influence of the various parameters on the BOD and DO profiles.
W71-06186

PHYSICAL PROPERTIES AND PROCESSING CHARACTERISTICS OF MACROPHYTES AS RELATED TO MECHANICAL HARVESTING,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 04A.
W71-06188

MARGINAL COSTS OF ALTERNATIVE LEVELS OF WATER QUALITY IN THE UPPER MISSISSIPPI RIVER,
Minnesota Univ., St. Paul.
Robert Lewis Lewis.
Water Resources Research Center, Bulletin 25, University of Minnesota, Minneapolis, Minnesota, September 1970. 59 p, 12 fig, 6 tab. OWRR Project A-019-MINN (2).

Descriptors: *Water quality, *Marginal costs, Management, Waste treatment, Treatment facilities, Dissolved oxygen, Cost analysis.
Identifiers: *Treatment expenditures, Analytic framework, Environmental problems, Upper Mississippi River, Twin Cities.

The purpose of this study is to identify the physical, institutional and economic interrelationships that affect and are affected by the quality of the water in the Mississippi River in the Twin Cities area. The

hypothesis tested in the thesis is that a cost minimizing management plan can be devised which will maintain the current dissolved oxygen (DO) river standard in the study area in a manner that is both physically and economically feasible under exisitng conditions. (A management plan is assumed to be economically feasible if the increase in the total annual cost of treatment does not exceed 10% of the present annual expenditure.) If the hypothesis is accepted, then the Sewer Service Board could maintain the DO river standard at a moderate increase in annual treatment expenditure by providing a more efficient allocation of treatment among the five treatment plants. The objectives of the study include: (1) identify the physical, institutional, and economic conditions related to water quality; (2) propose an analytical framework for combining the physical properties of the river with costs of treatment; (3) determine the highest possible DO river standard feasible with existing treatment facilities during summer low flows; (4) test hypothesis that minimum cost management scheme can be found which will maintain the current DO river standard in a manner both physically and economically feasible under existing conditions. It is concluded that the change in the institutional structure adopted by the Minnesota League will lead to a more efficient allocation of treatment expenditures at the five treatment plants. (Wray-Chicago)
W71-06191

IMPLICATIONS OF WATER QUALITY LAWS FOR THE FEEDLOT INDUSTRY,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
Ron E. Shaffer, and Daniel E. Badger.
Oklahoma Current Farm Economics, March 1970, Vol 43, No 1, p 3-11. 2 tab, 19 ref.

Descriptors: *Water pollution control, *Pollution abatement, *Water management (Applied), *Water Quality Act, *Environmental effects, Lagoons, Water pollution effects, Waste disposal, Cost sharing, Legal aspects, Social aspects, Fertilizers, Benefits, Arid lands, Dry seasons, Waste dilutions, Stabilization, Dissolved solids, Oklahoma, Texas, Return (Monetary), Profit, Water utilization, Productivity, Streams, Legislation, Cattle, Water treatment, Waste treatment.
Identifiers: *Quality alteration, *Trade off, *Feed lot industry, *Beef feeding industry, *Feed Yards Act.

Agricultural water users historically considered the amount of wastes and impurities that could be discharged; recent emphasis is to keep pollutants from streams. Feedlot operators must integrate and coordinate the total production process to efficiently use resources for a profitable return. They must know what legal and social requirements they have in environmental protection through water management. Large-scale operations in Texas and Oklahoma, with up to 40,000 head capacity, predominate the beeffeeding industry. The Water Quality Act and Feed Yards Act require elimination of interstate water pollution and water-resource enchancement. Oklahoma requires feedlot licensees to provide reasonable waste disposal and drainage to avoid pollution. Feedlot runoff is discussed in terms of removing undesirable solids by stabilization lagoons and dilution. These methods present special problems in dry seasons and in arid lands. Waste disposal of manure as fertilize sales is not economical, but social and legal benefits of pollution-free rivers are high. Cost sharing waste control projects are outlined. Future feedlot locations must consider access to waste disposal as well as beef markets. Environmental quality is a dimension new to the industry, which will be developed when society can tradeoff between production efficiency and environment, or develop cost-sharing programs. (Popkin-Arizona)
W71-06222

SUSQUEHANNA RIVER BASIN STUDY (SUMMARY),
For primary bibliographic entry see Field 06B
W71-06227

YORK RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN-VOLUME 1, INTRODUCTION.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W71-06230

INDUCED AIR MIXING OF LARGE BODIES OF POLLUTED WATER,
Maine Univ., Orono. Dept. of Chemical Engineering.
Stefan A. Zieminski, and Raymond C. Whittemore.
Copy available from GPO Sup Doc as: I67.13/4: 160800WP, 11/70, $.0.60; microfiche from NTIS as PB-198 220, $0.95. EPA-WBO Report No 16080 DWP, Nov 1970. 46 p, 32 fig, 5 tab, 26 ref.

Descriptors: *Aeration, *Water quality control, *Air entrainment, Coalescence bubbles, Mixing, Diffusion, Tracers.
Identifiers: Air plume, Energy input.

Induced air mixing of large bodies of water was investigated. The objective was to conduct a pilot-scale study to estimate the effects of variables such as the air flow rate, geometry of the body of water, energy input, size of air bubbles, and the pumping capacity of the air plume on the time of mixing. The latter was defined as the time required to reach 90% of the equilibrium concentration of the KCl tracer. In the study emphasis was put on the direction and relative magnitudes of the variables in order to obtain guidelines for large-scale investigation. Considerable time was spent on the development of the various experimental techniques. The tests were conducted in a plexiglas tank of 180 gallons capacity. It is stressed that the induced air system was investigated only from the viewpoint of its mixing performance. Its effect on aquatic life was not considered.
W71-06245

DEVELOPMENT OF PHOSPHATE-FREE HOME LAUNDRY DETERGENTS,
IIT Research Inst., Chicago, Ill.
Karl A. Roseman, and Warner M. Linfield.
Copy available from GPO Sup Doc as EPA-WQO Report No 16080 DVF, December 1970, $1.00; microfiche from NTIS as PB-198 222, $0.95. 103 p, 4 tab, 10 ref. EPA-WQO Contract 14-12-575.

Descriptors: *Detergents, *Algal control, *Formulation, *Surfactants, *Eutrophication, Linear alkylate sulfonates, Chelation, Phosphates, Organic compounds, Water pollution control.
Identifiers: Phosphate-free detergents, Trisodium nitrilotriacetate, Sodium citrate.

Basic studies were performed towards the development of phosphate-free home laundry detergents. Five surfactants were synthesized with the idea that they might possess hard ion chelating properties. The cleaning abilities of these materials were compared to the widely used linear alkylbenzene sulfonate as incorporated into the same formulations. The detergent compositions contained 2% carboxymethylcellulose and the silicate content was varied. Sodium acetate and sodium carbonate were investigated as possible reservoirs of alkalinity. Surfactant compatibility with sodium chloride and sodium sulfate was examined. Other additives included trisodium nitrilotriacetate and sodium citrate at moderate levels. Fifteen detergent formulations were screened and the results leave little doubt that acceptable phosphate-free home laundry detergents can be developed.
W71-06247

INVESTIGATION OF MEANS FOR CONTROLLED SELF-DESTRUCTION OF PESTICIDES,
Aerojet-General Corp., El Monte, Calif. Environmental Systems Div.
Keith H. Sweeny, and James R. Fischer.
Copy available from GPO Sup Doc as No 1604 ELO, June 1970, $1.25; microfiche from NTIS a PB-198 224, $0.95. EPA-WQO Report No 1604 ELO, June 1970. 128 p, 7 fig, 3 tab, 64 ref. EPA WQO Contract No. 14-12-596.

Descriptors: *Pesticide removal, *DDT, *Reduc tion (Chemical), Chlorinated hydrocarbon pesti cides, Soil environment, Waste water treatment Pesticide residues.
Identifiers: *Pesticide degradation Polychlorinatedbiphenyls, PCB, DDE.

Laboratory studies demonstrated the feasibility o controlled destruction of chlorinated pesticide such as DDT. The concept comprised (1) means t degrade DDT to a harmless form, and (2) method to delay the reaction for given pest-control action Chemical methods for degrading DDT were screened and reduction was selected as the mos promising technique. Destruction of DDT, withou forming DDE as a product was demonstrated by mildly acidic reduction with zinc powder. The principal product is bis (p-chlorophenyl)ethane, DDT with all three aliphatic chlorines removed; a material stated to be 'void of the neurotoxic effects of DDT.' Catalysis of the reaction resulted in complete destruction of DDT in 1 hr at 25 degrees C and conversion to bis (chlorophenyl)ethane in 4-8 hrs. Catalyzed aluminum or iron reduction of DDT produced tetra (p-chlorophenyl)-tetrachlorobutane, reportedly lipoid insoluble. Reductive degradation of dieldrin, endrin, aldrin, chlordane, heptachlor, toxaphene, and selected polychlorinated biphenyls was also shown. A 90% destruction of DDT in laboratory soil was shown in 4 days by this technique. Degradation of DDT in water was demonstrated also, a 421 mg/l suspension being reduced to 1 ppm after 1 hr reaction at 75 degrees C. Reaction delay can be achieved with wax or silyl coatings which are slowly dissolved or eroded. Coatings were produced which stopped zinc-acid reaction.
W71-06249

INDUCED HYPOLIMNION AERATION FOR WATER QUALITY IMPROVEMENT OF POWER RELEASES,
Robert S. Kerr Water Research Center. Ada, Okla.
Lowell E. Leach, William R. Duffer, and Curtis C. Harlin, Jr.
Copy available from GPO Sup Doc as Report No 16080, October 1970, $0.50; microfiche from NTIS as PB-198 226, $0.95. Report No 16080, October 1970. 32 p, 15 fig, 2 tab, 21 ref.

Descriptors: *Aeration, *Thermal stratification, *Impoundments, *Hypolimnion, Dissolved oxygen, Mixing, Oxygenation, Air entrainment, Thermocline, Epilimnion.
Identifiers: *Water quality control, *Induced aeration, *Reservoir destratification, Air distribution system, Oxygenation efficiency, Power release aeration.

Conventional hydraulic structures in most dams withdraw low flow and power releases from the poor quality hypolimnion waters during summer stratification resulting in serious degradation of long reaches of streams below dams. Induced aeration of hypolimnion waters during summer stratification has great potential in water quality management of power releases, low flow releases, and limited volumes of impoundments without costly modification of existing outlet works. Hypolimnion aeration research on power discharge quality improvement was conducted at Eufaula Reservoir in southeastern Oklahoma during the summer of 1968. Dissolved oxygen transfer efficiency of the aeration system ranged from 1.8 to 3.0 pounds of dissolved oxygen per horsepower-hour of expended energy resulting in an operating cost of 4.10 to 6.25 dollars per 1,000 pounds of oxygen incorporated into the power releases. Additional research for development and optimization of the induced aeration system is discussed. (Leach-EPA-WQO)
W71-06251

ARBONATE BONDING OF COAL REFUSE,
ack, Sivalls and Bryson, Inc., Pittsburgh, Pa. Applied Technology Div.
ul J. LaRosa, James A. Karnavas, and Eugene A. czarski.
py available from GPO Sup Doc as I67.13/4: 010FOA 02/71, $0.60; microfiche from NTIS as -198 230, $0.95. EPA-WQO Report 14010, A, Feb 1971. 44 p, 9 tab, 22 fig, append. EPA-QO Grant 14010 FOA.

scriptors: *Acid mine water, *Coal mine waste, alcium carbonate, *Sealants, Carbon dioxide, lution abatement, Road construction, Water lution control, *Binders.
ntifiers: *Carbonate bonding, *Coal refuse der.

aboratory study of the variables which affect the perties of the carbonate bonded coal refuse has n made. The carbonate bonding process utilizcoal refuse as a fill material consists of mixing l refuse with water and lime hydrate, compactthe mixture, and reacting it with a carbon-dioxrich gas to form a coherent structure bonded by atrix of calcite crystals. The resulting carbonate ded coal refuse can be used in road building or coal refuse pile sealant to minimize acid mine er pollution. Four types of coal refuse were iigated--a relatively unoxidized and highly oxed bituminous coal refuse and a relatively unoxed and highly oxidized anthracite coal refuse. It found that compressive strengths of 2200 to 0 psi were obtained for the four types of coal se investigated using up to 12 percent lime rate and 9 to 15 percent water. In general, the pressive strength of the carbonate bonded coal se increases with increasing lime hydrate con- reaction time and carbon dioxide concentrain the carbonate bonding reaction gas. The air water permeability of carbonate bonded coal se was found to be comparable to concrete. An oximate cost comparison between carbonate led coal refuse and other construction materiand techniques indicated that the carbonate ling process utilizing coal refuse is the least means available for coal refuse pile sealing and building. (LaRosa-Black, Sivalls and Bryson) -06256

STE REDUCTION IN FOOD CANNING RATIONS,
onal Canners Association Research Founda- Berkeley, Calif. Western Research Lab.
rimary bibliographic entry see Field 05D.
-06257

TRACT OF PROCEEDINGS, HAZARDOUS LUTING SUBSTANCES SYMPOSIUM: EX 1 TO STUDY ON CONTROL OF ARDOUS POLLUTING SUBSTANCES, '. 14-16, 1970. NEW ORLEANS, LA.
t Guard, Washington, D.C.
rimary bibliographic entry see Field 05B.
06270

AWARE RIVER BASIN COMM'N HEAR- TO EXPAND THE COMPREHENSIVE N.
rimary bibliographic entry see Field 06E.
06274

RING BY DELAWARE RIVER BASIN M'N TO EXPAND THE COMPREHENSIVE i.

al Register, Vol 35, No 2421, p 18.991, Dec 970. 1 p.

iptors: *Interstate compacts, *Interstate issions, *Sewage treatment, *Administrative ies, Administrative decisions, Cities, Sewage ts, Local governments, Federal government, ylvania, Water sources, Wells.

The Delaware River Basin Commission published notice of hearings to amend the Comprehensive Plan. Proposed amendments to expand the Comprehensive Plan are: (1) a modification of the existing treatment plant in Haverford Township, Pennsylvania to remove 90 per cent of BOD5 from 5.4 million gallons per day of sewage flow prior to discharge in Darby Creek; and (2) utilization of two existing wells as emergency water sources for Bethelehem, Pennsylvania. (Hart-Florida)
W71-06275

CERTIFICATES OF FINANCIAL RESPONSIBILITY (OIL POLLUTION).
For primary bibliographic entry see Field 06E.
W71-06276

STATE WATER CONTROL LAW.
For primary bibliographic entry see Field 06E.
W71-06277

GOVERNMENTAL RESPONSIBILITY FOR WASTE MANAGEMENT IN URBAN REGIONS,
Richard T. Anderson.
Natural Resources Journal, Vol 10, No 4, p 668-686 (Oct 1970). 19 p, 1 tab, 30 ref.

Descriptors: *Wastes, *Integrated control measures, *Regional analysis, *Municipal wastes, Federal government, State governments, Local governments, Inter-agency cooperation, Institutional constraints, Political constraints, Interstate, Planning, Political aspects, Administration, Coordination, Decision making, Domestic wastes, Regions, Environmental sanitation, Waste disposal, Waste water disposal, Waste treatment, Non-structural alternatives.

The allocation of governmental waste management responsibility is analyzed in this article. Four premises are employed in the analysis: (1) waste management is a collective, public responsibility; (2) solid, liquid, and gaseous wastes are related; (3) the urban-waste problem is regional; and (4) intergovernmental action is required. The three issues examined are: (1) determination of environmental quality levels, costs, and benefits, (2) ascertainment of the most efficient managerial system; and (3) the respective roles of the federal, state, regional and local governments. Determining national environmental policy and providing a financial commitment to the policy is held to be the role of the federal government. The state roles are said to include policy development on a state level and the design and operation of waste-management programs in cooperation with local governments. The desirability and scope of regional authority in fulfilling state responsibilities is analyzed in the light of four criteria: (1) geography, (2) desirable levels of operational authority, (3) functional duties, and (4) metropolitan representation. Six alternative approaches to regional waste management are presented by the author. (Earl-Florida)
W71-06282

GRANTS FOR PREPARATION OF COMPREHENSIVE AREA PLANS FOR WATER AND SEWER SYSTEMS.
Department of Agriculture, Washington, D.C.
For primary bibliographic entry see Field 06A.
W71-06284

PLASTICS IN WATER AND SEWAGE CONTROL,
For primary bibliographic entry see Field 08G.
W71-06286

RUBBER TANKS AID SEWAGE FIGHT,
Jonathan Eberhart.
Sci News, Vol 94, No 5, p 115, Aug 3, 1968.

Descriptors: *Construction materials, *Construction costs, Storm runoff, Overflow.
Identifiers: *Storm overflows, Rubber storage containers, Washington, D.C.

In Washington D.C.'s Anacostia River, a new technique is being tried to eliminate pollution of the river caused by sewage overflows during severe rainstorms. This new method is less expensive than Chicago's underground sewer project which will cost almost $15 million for the pilot project and more than $2 billion for city-wide installation. In Washington, large rubber tanks will be anchored beneath the surface of the Anacostia. Stormwater and sewage overflow will be diverted to these tanks and stored there until the water has receded, and the tanks' contents can be pumped to the nearby sewage treatment plant.
W71-06290

WATER POLLUTION CONTROL. 5 BILLION DOLLARS TAB,
C. Laverty.
Rubber World, Vol 160, No 1, p 48-49, Apr 1969.

Descriptors: *Rubber, *Biocontrol, Water pollution control, Construction materials.
Identifiers: *Rubber storage containers, Rubber gates, Acid-resistant hose.

A summary is given of various uses of rubber for combatting water pollution. Chunks or strips of rubber compounds containing relatively insoluble organo-metallic compounds or alkanolamine salts of salicylanilides as toxicants are dropped into contaminated water for biocidal action lasting one year or more. Other antipollution methods employ: giant (100,000 gal) rubberized Pillow tanks, used as temporary storage for sewage overflow triggered by heavy rains; nylon-reinforced polychloroprene Fabridam rubber gates for storm control; and acid-resistant hose, for carrying pickle liquor to storage tanks for treatment and ultimate disposal in underground sandstone reservoir.
W71-06297

LAND USE FUNCTION IN WATER QUALITY MANAGEMENT,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 06B.
W71-06310

MODELING AND CONTROL OF THE POLLUTION OF WATER RESOURCES SYSTEMS VIA MULTILEVEL APPROACH,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
For primary bibliographic entry see Field 06A.
W71-06311

CHARACTERIZATION AND CONTROL OF COMBINED SEWER OVERFLOWS, SAN FRANCISCO,
For primary bibliographic entry see Field 08B.
W71-06326

MIDLAND DISTRICT CENTER.

Inst Public Health Engrs, Vol 67, Part 1, p 51-57, Jan 1968.

Descriptors: *Overflow, *Sewage treatment.
Identifiers: *Storm tank, Great Britain.

The reconstructed and extended Kidderminster Sewage Works will content with excess water runoff by passing the overflow through screens or by storing it in stormwater tanks. The tanks will contain underwater sludge scrapers. Flow will be diverted from the river until all the tanks are individually filled. The stored water will eventually be pumped out for treatment.
W71-06331

IT'S IN THE BAG.

Am City, Vol 84, No 4, p 88, Apr 1969.

Descriptors: *Storage tanks, Overflow, Storm runoff, Ohio.
Identifiers: *Rubber storage containers, Combined sewers, Storm tank.

The problem of stormwater overflows from combined sewers is being combatted in Sandusky, Ohio through the implementation of a plan which is much less costly than the common solution of sewer separation. The new system consists of rubberized storage reservoirs that trap the heavily-polluted 'first flush' of stormwater. When the storm ends, pumps transfer the stored stormwater to the treatment plant for processing along with the normal waste water. Costs, details, and a diagram of the system are included in the article.
W71-06332

WORK STARTS ON 11-MILE INTERCEPTOR TO SOLVE TORONTO'S SEWER PROBLEM.
For primary bibliographic entry see Field 08A.
W71-06337

STORMWATER OVERFLOW GETS BAGGED.

Eng News-Record, Vol 181, No 18, p 14, Oct 31, 1968.

Descriptors: *Construction equipment, *Construction costs, *Separation techniques, Overflow.
Identifiers: *Rubber storage containers.

The FWPCA is financing projects to install rubber stormwater storage bags at three locations: Washington's Anacostia River, Sandusky, Ohio at Lake Erie, and Cambridge, Md.'s Choptank River estuary. The bags will store stormwater overflow that normally flows untreated into rivers and lakes along with sanitary sewage, when flows exceed treatment plants' capacities during heavy rainfall. The Washington bags rest on the bottom of the Anacostia River offshore of the pumping plant. The plant will chop overflow solids before the water reaches the bags, and an aerator will suspend the solids. The solids come out with the stored water when it is pumped back into the sewers for treatment. These plans are considerably less costly than sewer separation which would cost an estimated $48 billion to accomplish throughout the United States.
W71-06341

STORAGE BLADDERS FOR SEWAGE.

Ind Water Eng, Vol 5, No 8, p 30, Aug 1968.

Descriptors: *Construction equipment, *Rubber, *Storage tanks, Storm runoff, Overflow.
Identifiers: *Rubber storage containers, *Anacostia River.

Two large 100,000 gallon tanks of nylon-impregnated rubber have been anchored in metal cradles on the bottom of the Anacostia River. During rainfall the tanks are used to hold overflow and later, when the water has receded, the tanks are emptied and their contents pumped easily to the sewage treatment plant. These tanks have also been used for holding fuel, water, oil, beer, and wine.
W71-06344

INTERNATIONAL BUILDING EXHIBITION - OLYMPIA LONDON 13-25 NOVEMBER 1969.
For primary bibliographic entry see Field 08A.
W71-06348

DRAINAGE AND TREATMENT.

Surveyor, Vol 82, No 3988, p 150, Nov 9, 1968. 1 fig.

Descriptors: *Piping, Pipes, *Linings, Drainage engineering, Drainage systems, Plastic pipes, Sewers.

This brief review of recent advances and contracts in drainage and treatment includes a description of a new continuous length land drainage piping made from rigid unplasticised PVC which can be laid by mole-ploughing with backfill fed into the trench via a hopper above the plough. Also described is a new inexpensive method for relining sewer pipes using a sectioned plastics pipe, and a contract for a new L1/2 million, mile-long trunk sewer.
W71-06351

COMBINED SEWER SOLUTION SOUGHT IN SANDUSKY FIELD DEMONSTRATION.
Water Sewage Works, Vol 116, No 10, p 386-387, Oct 1969.

Descriptors: *Overflow, *Construction materials, Storm runoff.
Identifiers: *Storm overflows, Rubber storage containers, Storm tank, Sandusky, Ohio.

The use of flexible rubber containers for off-shore underwater temporary storage of storm overflow from a combined sewer has been proposed for the Sandusky Bay area as the answer to its storm overflow problems. The containers are predicted to temporarily hold overflows equivalent to a one-year storm. When the plant can handle the excess, the contents of the containers are pumped back to the plant where the sewage is treated and piped into the bay.
W71-06352

STORM WATER STORAGE SCHEME.

Water Waste Treat, Vol 12, No 7, p 221, May/Jun 1969.

Descriptors: *Construction materials, *Storm runoff.
Identifiers: *Rubber storage containers, *Storm overflows, *Sandusky, Ohio, Storm sewage.

A pilot project to study the storage of storm sewage from combined sewers at Sandusky, Ohio, is described. Two 100,000 gallon collapsible fabric-reinforced rubber tanks have been installed on the bottom of Sandusky Bay; the tanks will fill by gravity and will temporarily store overflows equivalent to a 1-year storm on a small area. Subsequently the storm sewage will be pumped to the works for treatment and discharged to the bay between storms.
W71-06357

APPLIES EXISTING TECHNOLOGY FOR A CLEANER LAKE ERIE.

Am City, Vol 85, No 4, p 18, Apr 1970.

Descriptors: *Waste treatment, *Storage, Instrumentation, Storm runoff.
Identifiers: *Lake Erie, Monitoring system, Stormwater storage.

The Detroit Metropolitan Water Service is putting existing technology into effect to help decelerate the aging of Lake Erie. Proposed programs include: solids reduction by addition of mechanisms to the regional waste water plant, coliform removal through chlorination, phosphate reduction using pickle liquor from steel mills, waste oil and grease removal using oil skimmers, construction of phenol-removing systems, and installation of smokestack air cleaners to prevent air pollution. A monitoring system to reduce stormwater overflows is also being built to warn of approaching rainfall, thus allowing sewers to be pumped before the storm. This will permit sewers to store contaminated stormwater, the dirtiest water being sent to the treatment plant. Further long range plans are being made to meet future demands of the region.
W71-06359

STEEL PIPE SELECTED FOR STORM SEW SYSTEM.
For primary bibliographic entry see Field 08G.
W71-06360

UNDERWATER SEWAGE STORAGE AN TO POLLUTION ABATEMENT.

Am City, Vol 84, No 9, p 30 and 34, Sep 1969.

Descriptors: *Construction materials, Storm noff, Pollution abatement, Waste storage, O flow.
Identifiers: *Rubber storage containers, St tank, Anacostia River.

Goodyear Tire and Rubber Co. and Underw Storage, Inc. of Washington D.C. have announ a joint project to attack water pollution by coll ing wastes in huge, collapsible, underwater, berized tanks. Two prototype systems are b tested in the Anacostia River in Washington; on trap stormwater overflow, and the other ne marina to collect wastes from boats. These sto tanks could resolve a variety of problems suc threats of river fires caused by accidentally-ign oily wastes, and pollution from stormwater w was previously eliminated only through co sewer reconstruction.
W71-06361

UNDERWATER LINE SPANS 32 FE BETWEEN SUPPORTS.
For primary bibliographic entry see Field 08F.
W71-06362

SYMPOSIUM ON STORM SEWAGE OV FLOWS.

Inst Civil Engrs (London), 1967. 160 p.

Descriptors: Hydraulics, Statistics, Overflow.
Identifiers: Sewer separation, Storm sewage.

The twelve papers presented consist of experim tal studies, which provide technical data on f conditions, performance of sewerage systems design factors for various situations. Particular tention is paid to behavior of mixed flows and both vertical and horizontal separation methods
W71-06363

STORM WATER RETARDING BASINS SOL URBAN DRAINAGE PROBLEMS,
A. P. Aitken.

Descriptors: *Watersheds (Basin), Drain systems, Design, Hydraulics, Hydrologic aspects
Identifiers: *Australia, Stormwater Basins.

Urban flooding problems solved by Melbourne the Metropolitan Board of Works are discuss Hydrologic and hydraulic problems posed in des of retarding basins are explained. 16 stormwater tarding basins varying in capacity from 13 to 2 acre feet were constructed to reduce peak f downstream of basin by temporarily storing port of inflow from upstream catchment. Land acqu tion, design considerations, and cost of basins mentioned.
W71-06364

FREQUENCY OF STORM-SEWAGE OVE FLOWS. THE FREQUENCY OF STOR SEWAGE OVERFLOWS IN COMBIN SEWERAGE SYSTEMS IN CONNECTI WITH STORAGE AND PUMP CAPACITY, CO CLUSIONS FROM THE RAINFALL DATA THE KNMI FOR 1926-1962,
W. O. J. Bottger, and A. G. v.d. Herik.
Water (WTRHA7), Vol 50, p 154-161, 1966.

Descriptors: *Overflow, Data collections, Frequ cy analysis, Precipitation (Atmospheric).
Identifiers: *Storm sewage, *Netherlands.

abulated and graphical data on the number of perations of storm-sewage overflows and the nounts of overflow at De Bilt, Netherlands, in the eriod 1926-1962 are presented. These data were mpiled by a computer using the Ribbius-Kragt-uipers method (in which it is assumed that no erflow will occur until the sewers are filled to the est of the lowest weir). The average overflow equency, calculated monthly, reached a max-um in August and a minimum in March. Results r individual years and individual months were ite variable, and no useful relations could be und between the annual precipitation, the mber of operations of the overflows, and the nounts of overflow.
71-06365

ORM OVERFLOWS AND STORM SEWAGE,
nn T. Calvert.
rveyor, Vol 85, p 22, Apr 1970.

scriptors: *Sewage disposal, *Design standards, esign criteria, *Separation techniques.
ntifiers: *Storm overflows, *Storm sewage, eat Britain.

nclusions of the Final Report of the Technical mmittee on Storm Overflows and the Disposal of rm Sewage are summarized. The Ministry of using and Local Government accepted the re-t's recommendations regarding the general ign and setting of storm overflows, and they are sidering recommendations for further research investigation. The major outcome of the report poses a formula for the setting of storm over-ws which replaces the former method of fixing setting at 6 d.w.f. Features and advantages of formula are given. Sewer separation was con-red but eventually rejected by the committee ause of the huge cost involved and the inevita-pollution from surface water drains of separate ers. Other areas studies were the effects of m sewage on rivers and the composition and ngth of storm sewage.
1-06367

RE THAN JUST A BUILDING,
primary bibliographic entry see Field 08A.
1-06369

ITHER WATER POLLUTION CONTROL,
. James.
er Pollution Control, Vol 67, No 5, p 579-583, 1968.

criptors: *Sewage disposal, *Water pollution, erflow, Flow rates.
tifiers: *Hydraulic analysis, Storm sewage.

author comments on sewage disposal, river ution prevention services, and research in a ral manner. He contends that storm overflow lems are more easily solved on large works on smaller ones. James contests the equivalent xd.w.f. for the sewage rate of flow in dry her as the standard measurement.
-06370

TICAL OBSERVATIONS FOR HYDRAULIC SUREMENTS OF FIXED STORM-SEWAGE RFLOWS,
nne.
erwirtsch-Wassertech (WSWSAO), Vol 17, p 122-127, Apr 1967.

riptors: *Specific capacity, Sewerage.
ifiers: *Storm overflows, Combined sewers.

nnection with hydraulic measurements for sewage overflows, the author discusses the s which are caused by using the concept 'dilu-The specific concentration of one or more nces (referred to as the specific load) is mmended as the criterion for the permissible f combined sewerage systems on the receiv-ater. Equations are developed for calculating the maximal critical values for the specific load and runoff.
W71-06372

OVERFLOW STUDIES AT A SEWER SYSTEM OF A METROPOLITAN CITY,
For primary bibliographic entry see Field 08B.
W71-06373

ALTERNATIVES TO SEPARATION OF COMBINED SEWERS,
For primary bibliographic entry see Field 05D.
W71-06374

METHOD OF AND MEANS FOR DEALING WITH STORM-WATER OVERFLOWS IN SEWERS AND LIKE DRAINAGE SYSTEMS,
For primary bibliographic entry see Field 08B.
W71-06375

STEPS TO SUCCESS IN WATER POLLUTION CONTROL,
Charles V. Gibbs.
Public Works, Vol 101, No 5, p 62-67, May 1970.

Descriptors: *Overflow, *Pollution abatement, *Sludge digestion, Sewage treatment, Separation techniques.
Identifiers: *Interceptor sewer, *Seattle, Combined sewers.

Plans and actions of the Municipality of Metropolitan Seattle (Metro) in regard to combatting the city's water pollution problems are presented. Metro has devised various solutions to underground construction problems with pipelines and pumping stations. Other problems tackled by Metro include the removal of digested sludge from Puget Sound and the elimination of combined sewer overflows. Sewer separation is not presently feasible because of the expense, so the Metro interceptor system is being ordered to run the entire system. In the meantime, money originally reserved for storm water holding tanks is being contributed to the city's proposed sewer separation system. Metro is continuing its innovative engineering programs and is coordinating its activities with community agencies working in the same or related fields.
W71-06379

LETTERS TO THE EDITOR--WATCh OUT FOR CROSS CONNECTIONS,
Gary D. Hutchinson.
Am City, Vol 84, No 1, p 21, Jan 1969.

Descriptors: *Construction equipment.
Identifiers: *Storm sewers.

Additions are made to a previously-published article concerning hazards of well-to-storm-sewer connections. In one southeastern city, these connections were not protected from backflow, thus, the municipal water system was subject to dangerous innundation from storm sewers. City officials corrected the situation by installing above-ground, air-gap separations.
W71-06381

NEW REGULATIONS AND CONSTRUCTIONS OF STORM-SEWAGE OVERFLOWS, FOR THE RELIEF OF RECEIVING WATERS,
For primary bibliographic entry see Field 08B.
W71-06382

A BREAK FROM ACCEPTED PRACTICE . . . BRINGS STORM-WATER CONTROL WITHIN REACH OF OUR BOROUGH'S POCKETBOOK,
L. L. Lowry.
Am City, Vol 83, No 6, p 108-109, Jun 1968.

Descriptors: *Reservoir storage, Storm runoff.
Identifiers: *Stormwater control.

State College, Pa. constructed a reservoir to contain runoff until after a storm instead of installing a more costly water-carrying conduit. An electrically contolled gate closes when rain causes the water level in the reservoir to rise, and it opens when the storm subsides, thus, allowing the rainwater to drain. As a part of State College's sewage project, a new storm trunk line was built contrary to common practice; that is, from the center of the job downstream, to reduce the threat of the pipe coming afloat in the event of a flash flood. This plan was also successful; flood water was forced inside the pipe rather than flowing around the outside and causing flotation. State College also formed a Storm Water Authority to undertake the financing of such storm water control project.
W71-06384

WATER STORAGE METHODS -- FROM CUPPED HANDS TO COMPUTERS,
For primary bibliographic entry see Field 08A.
W71-06385

THE SEWER HAD TO BE CLEANED BEFORE SNOWFALL,
Charles Knecht.
Am City, Vol 84, No 10, p 120 and 123, Oct 1969.

Descriptors: *Maintenance, *Sewers, Hydraulics.
Identifiers: *Sewer cleaning, Sewer hydraulics.

In Houghton, Michigan, a cold-climate town, water pollution and sewage problems are serious due to the sand and grit from street traction abrasives, which enter sewer interceptors during rain and spring thaw conditions. Not only do the interceptors become clogged and sewers inoperable, but public health is threatened by unclean water developing from overflow bypassing treatment. The town hired a company this year to utilize traditional cleaning techniques to unclog the sewer system. The line was only two years old and designed to self-clean, but preventive maintenance programs are necessary for all sewers in cold-climate towns like Houghton.
W71-06396

EXPERIMENTAL ESTIMATION OF DETENTION IN STORM SEWER SYSTEM,
For primary bibliographic entry see Field 08B.
W71-06404

HOW TO THINK ABOUT INSTRUMENTATION AND CONTROL,
Martin L. Roth.
Calif Water Pollution Control Association, Los Angeles, Bulletin, Vol 6, No 2, p 12-18, Oct 1969.

Descriptors: *Sewage treatment, *Instrumentation, *Control structures, *Control systems, *Treatment facilities.

Instrumentation and control are defined and applied to a sewage treatment process. Guidelines for operators are directed toward achieving highest efficiency from plant installations.
W71-06409

STORM OVERFLOWS AND THE DISPOSAL OF STORM SEWAGE.
For primary bibliographic entry see Field 08A.
W71-06417

NOTES ON WATER POLLUTION.
Inst Sewage Purif, J Proc, Part 2, p 199-202, 1966. 1 graph, 3 ref.

Descriptors: *Sewers, Investigations, Sewage, Water pollution, Runoff, Storage tanks.
Identifiers: *Storm sewage, *Combined sewers, *Storm overflows, Great Britain.

Studies were performed in three areas served by combined sewerage systems on the amount, com-

position, and pollution load of stormwater overflows. There was regularity in the volume of storm sewage at the three sites in relation to impermeable area, total rainfall, and dry-weather flow; however, no regularity was detected in composition. Generalizations were made regarding runoff, sewage dilution, single storm discharges, etc., and specifics for each locale were also described. Recommendations were made for the placement of storage tanks alongside of storm overflows and for experimentation in designing different types of overflows in order to reduce pollution load discharges.
W71-06418

MAIN DRAINAGE,
For primary bibliographic entry see Field 08A.
W71-06422

COMPUTERS IN HONG KONG PUBLIC WORKS,
A. T. Armstrong-Wright.
Surveyor, Vol 84, No 4029, p 34-39, Aug 22, 1969. 12 fig.

Descriptors: *Computers, *Computer programs, *Project planning, Highways, Water supply, Expenditures, Sewage disposal, Design, Hydrologic data.

This article describes applications of electronic computers to public works projects in Hong Kong. Their feasibility is obvious due to their speed and accuracy. Applications of computers are discussed for the following areas: project scheduling; highways (road alignment, flyover beam design, pile loading and setting-out road curves and flyovers); water supply (hydrologic data, dam stability analyses, flood balancing reservoirs, yield of water supply schemes, operation of reservoirs, and project appraisal); and expenditure control. In the area of sewage disposal, computers aid in developing suitable designs for multi-port diffusers on ends of submarine outfalls. Computers also process hydrologic data which engineers use in water management and operation of existing facilities. The author concludes that as time progresses, increased use will be made of computers, not only in sophisticated studies but also in day-to-day operations.
W71-06423

PLASTICS IN WATER AND SEWAGE CONTROL,
For primary bibliographic entry see Field 08G.
W71-06424

STRUCTURES PREVENT URBAN SEDIMENT DAMAGE,
For primary bibliographic entry see Field 04D.
W71-06425

INTRODUCTION: ISSUES IN FOOD PRODUCTION AND CLEAN WATER,
Agricultural Research Service, Beltsville, Md. Water Conservation Research Div
Cecil H. Wadleigh, and Clarence S. Britt
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Introduction, p xix-xxvii. 1 tab, 3 fig, 4 ref.

Descriptors: *Farm wastes, *Environment, Cattle, Poultry, Hogs, Ammonia, Fertilizers, Nitrogen, Corn, Labor, Nutrients, Potassium, Biochemical oxygen demand, Runoff, Fishkill, Effluent, Pesticides, Coliforms, Nitrates, Eutrophication, Phosphorus, Oxygen, Fish, Conservation, Lagoons, Odor, Sprinkler irrigation, Water quality
Identifiers: *Waste production, *Feedlots, Mechanization, Chicken litter

The article introduces the subject matter and content of the book. A look is first taken at the increased consumption of meat in this country. From the total number of animals raised for slaughter, an idea is given of the amount and scope of the animal waste disposal problem. To raise this large number of animals the agricultural industry has relied on a variety of chemical fertilizers and pesticides to increase yields. Runoff from feedlots and agricultural lands has caused eutrophication and associated fish kills. However these are not the only nutrient sources. Conservation practices are needed to prevent water flowing through feedlots to run directly into a water course. As such secondary or even tertiary lagoons may be required. Recycling of wastes should be the optimum means of disposal. Sound conservation farming is needed to assure beneficial use of agricultural wastes and to effectively protect the quality of water in our streams and reservoirs. (See also W71-05437) (White-Iowa State)
W71-06429

LAND AND WATER MANAGEMENT FOR MINIMIZING SEDIMENT,
Iowa State Univ. Ames. Dept. of Agronomy.
Minoru Amemiya.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 3, p 35-45. 5 tab, 28 ref.

Descriptors: *Land management, *Water management, *Sediments, *Soil erosion, Sediment yield, Soil stabilization, Sediment transport, Energy dissipation, Soil properties, Slopes, Farm management, Infiltration, Storage capacity, Vegetation, Velocity, Flow, Mulching, Erosion control, Cultivation, Runoff, Strip cropping, Terracing, Contour farming.
Identifiers: Detachment, Universal Soil Loss Equation.

The most logical and direct approach to solving our agriculturally related sediment problem is the stabilization of the sediment source by controlling soil erosion through the use of proper land and water management practices. An understanding of the factors affecting soil erosion by water is required in order to effectively protect the soil. The Universal Soil Loss Equation provides a framework for discussing erosion control measures. A vegetative cover or surface mulch is one of the most effective means of controlling runoff and erosion, and is discussed in some detail. A natural result of this fact is the creation of tillage methods which leave a mulch or crop residue on the surface. Examples of their effectiveness in controlling soil erosion are given. Contour farming, strip-cropping and terracing are slope modification methods for erosion control. Slope modification measures combined with soil conserving tillage practices can be effective in reducing soil erosion from cropped land. However, to become widely accepted, such practices must fit efficient farming operations and must be economically feasible. (See also W71-05437) (White-Iowa State)
W71-06432

FERTILIZER MANAGEMENT FOR POLLUTION CONTROL,
Minnesota Univ., St. Paul. Dept. of Soil Science.
W. P. Martin, W. E. Fenster, and L. D. Hanson.
Miscellaneous Publication Paper No 1360 of the University of Minnesota Agricultural Experiment Station, St. Paul. Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 9, p 142-158. 68 ref.

Descriptors: *Fertilizers, *Nitrogen, *Phosphorus, Nutrients, Phosphates, Soil erosion, Sedimentation, Sediments, Soils, Water supply, Eutrophication, Cultivation, Nitrates, Farm wastes, Wells, Water pollution, Nitrification, Irrigation, Denitrification.
Identifiers: *Pollution control, *Fertilizer use, Nutrient removal, Feedlots.

Nitrogen and phosphorus, as nutrient elements, are important to both land and aquatic plants, and normally reach water supplies via land runoff in the erosion debris. Fertilizer usages in the midcontinent area are rapidly increasing to maximi production and increase efficiency, and further creases are expected. Fertilizer phosphorus quic converts to unavailable forms in mineral soils a the evidence indicates that one of the ways reducing the level of soluble phosphorus in wa would be to effect soil contact such as by filtrati through the soil medium. Nitrogen fertilizer app cation rates should approximate crop needs, wh for a given soil type and climatic zone are based production potential estimates for the crops to grown. Management recommendations refin through the years for maximizing production a not incompatible with the objective of reduci nutrient contamination of natural waters. Furth research is needed on nutrient balances and re tions in soils to maintain supplies at levels need for crop production. Water quality standards established by the federal and state water polluti control groups should be compatible with the ne for maintaining adequate nutrients for efficie crop production consistent with management pr grams designed to minimize losses to adjace water supplies. (See also W71-05437) (White-Io State)
W71-06437

PESTICIDES AND PEST MANAGEMENT FO MAXIMUM PRODUCTION AND MINIMU POLLUTION,
Iowa State Univ., Ames. Dept. of Zoology and E tomology.
Don C. Peters.
Agricultural Practices and Water Quality, Io State University Press, Ames, Iowa, 1970, Chapt 14, p 209-223. 2 fig, 1 tab, 45 ref.

Descriptors: *Pesticides, *Pest control, Productiv ty, Water pollution, Climates, Insects, Contro Biocontrol, Cultural control, Chemcontro Mechanical control, Insecticides, Cotton, Timb management, Corn, Soybeans, Tobacc Chlorinated hydrocarbon pesticides, 2-4-D, DDT
Identifiers: *Pest management, Natural contro Applied controls.

The author first discusses natural and applied co trols which man utilizes in an effort to reduce loss caused by pests. Natural control can be subdivid into climatic, edaphic, and biotic aspects. Appli controls are biological, cultural, legal, or chemic practices. Examples of pest management in sever areas of production are given. The role of agricu tural pesticide use and clean water is pointed ou Suggestions are given, both legislative and prac cal, which can be used to reduce pesticide pollutio of water. If the public demand for sophistication pest control is to be achieved, more imaginati research support will have to be found. (See al W71-05437) (White-Iowa State)
W71-06441

LEGAL ASPECTS,
Iowa Univ., Iowa City. Coll. of Law.
N. William Hines.
Agricultural Practices and Water Quality, Io State University Press, Ames, Iowa, 1970, Chapt 26, p 365-376. 26 ref.

Descriptors: *Legal aspects, *Water pollutio Farm wastes, Pesticides, Sediments, Fertilizer Riparian rights, DDT, Water quality, Regulatio Water Quality Act, Standards, Administrativ agencies, Pesticide residues, Soil erosion, Silting.
Identifiers: *Point sources, Common la Nuisance, Feedlots, Registration.

The force of the law has not been brought to be on agriculture as it has on other major sources water pollution. Agricultural pollution has thus f been ignored because it is less visible and more di ficult to correct than are wastes from municipaliti and industry. Currently only those types of agricu tural pollution that are obvious and subject t direct control receive legal attention. As poi sources are brought under control, agriculture more subtle contributions to water pollution will a

tract regulatory concern. Public regulation of agricultural pollution will take two primary forms: (1) direct restrictions on the use of chemical inputs to agricultural production, and (2) regulation of land use patterns and practices. Examples of the first type of regulation are prohibitions or limitations on the use of certain chemical biocides, fertilizers, and other additives. Land use regulations seem very likely to be necessary to effect a meaningful reduction in soil erosion. The ideal construct might involve the employment of land-use controls by a comprehensive watershed management authority. If this does not come to pass, exercise of such powers by other local districts such as soil conservation districts, conservancy districts, or drainage districts would be feasible, as would granting similar powers to the local pollution control agency. (See also W71-05437) (White-Iowa State)
W71-06446

ECONOMIC ASPECTS,
Iowa State Univ., Ames. Dept. of Economics.
John F. Timmons.
Journal Paper No J-6469 of the Iowa Agricultural and Home Economics Experiment Station, Iowa State University, Ames, Iowa. Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 27, p 377-389. 9 ref.

Descriptors: *Water quality, *Economics, Management, Water quality control, Water resources, Costs, Benefits, Standards, Measurement, Water Quality Act.
Identifiers: *Quality levels, *Water supplies quality, *Water demand quality, Least cost method, Externalities, Public intervention, Water quality management, Quality use.

The first step toward meeting water quality management relating to water use within agriculture is being taken through becoming aware of the importance of water quality problems. The need to recognize the quality heterogeneities of water from demand and supply orientations is evident. The importance of demand orientations and requirements is paramount in specifying quality standards which vary among uses, spatially and temporally. Supply qualities must be geared to qualities demanded by uses. Least-cost methods are necessary in meeting demand qualities. In assigning benefits and costs to water uses, the problems of externalities, measurement, and intervention are crucial. Economics with its legacy of methods, theory, and its corps of resource economists is a necessary part of the multidisciplinary approach in planning and in carrying out relevant research necessary for education, legislation, and administration of water quality management. (See also W71-05437) (White-Iowa State)
W71-06447

ALLIANCE FOR ACTION,
Federal Water Pollution Control Administration, Kansas City, Mo. Missouri Basin Region.
John M. Rademacher.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970, Chapter 3, p 390-396. 10 ref.

Descriptors: *Farm wastes, *Water pollution, Agriculture, Fishkills, Pesticides, Sediments, Runoff, Regulation, Zoning, Management, Waste treatment, Dissolved oxygen.
Identifiers: *Feedlots, *Technical base, *Inventory, Registration, Feedlot runoff, Animal waste management, Quantities, Runoff strength, Population equivalent.

The author chooses to look at animal wastes since as pollutant lends itself to more classical solutions than do other agricultural pollutants. He then ices together the various interests involved with the animal waste problem. A technical base of information is required to establish effective controls. The development of an inventory noting animal production, concentration and location is an essential element of the technical base for the animal waste problem. Specific research and development needs must be delineated in accordance with the expected trends of the feedlot industry. Regulations are needed to ensure feedlot operators that measures they employ will guarantee a reasonable tenure of operation. Zoning regulations may be necessary and desirable. Mandatory registration should be an integral part of feedlot regulations. A sound animal waste management program encompasses prevention, reduction, treatment, and disposal of animal wastes. No one treatment process or system will be the solution for all animal production units. A variety of management and treatment systems will have to be developed. If it is the public who must bear the cost, then agriculture must have the courage to include waste treatment as a part of its production costs. (See also W71-05437) (White-Iowa State)
W71-06448

ACCOMPLISHMENTS AND GOALS,
Federal Water Pollution Control Administration, Washington, D.C. Agricultural and Marine Pollution Control.
Harold Bernard.
Agricultural Practices and Water Quality, Iowa State University Press, Ames, Iowa, 1970. Chapter 29, p 397-407. 2 fig, 1 tab, 2 ref.

Descriptors: *Water pollution, *Water quality, *Standards, Environment, Research and development, Management, Water Quality Act, Nebraska, Water supply, Water utilization, Water sports, Pollution abatement, Biochemical oxygen demand, Sewage treatment, Farm wastes, Nutrients, Return flow, Expenditures.
Identifiers: *Federal Water Pollution Control Administration, Agricultural pollution.

The article gives information as to the scope and extent of FWPCA activities relating to the control of agricultural pollution. Over $4 million has been expended in 1969 and 1970 on research and demonstrations involving pollution abatement from pesticides, nutrient runoff, irrigation return flows and feedlot operations. An example of criteria for water quality standards is given. Recommendations from a recent task force of seven cognizant Federal agencies studying the agricultural pollution problem are given. Data is presented indicating the need for municipal, industrial and agricultural pollution control. New techniques and systems must be developed to increase the quantity of pollutants removed from these sources before it reaches our streams. (See also W71-05437) (White-Iowa State)
W71-06449

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

UNDERSTANDING SYSTEMS ENGINEERING,
Lockheed-California Co., Burbank.
E. J. Kovalcik.
J Syst Manage, Vol 21, No 9, p 15-21, Sept 1970. 7 p, 3 fig, 8 ref.

Descriptors: *Systems engineering, *Methodology, *Objectives, Ideas, Management, Requirements, Analytical techniques, Optimization, Models, Benefit-cost analysis, Systems analysis, Project planning, Scheduling, Feedback, Procedures, Performance, Decision making.

The Systems Engineering (SE) method recognizes that each system is an integrated whole even though composed of diverse, specialized structures and subfunctions. The method also recognizes that any system has several objectives and that the balance between them may differ widely from system to system. The SE methods seek to optimize the overall system functions according to the weighted objectives and to achieve maximum compatibility of its parts. The major steps in SE that can be helpful in setting up a conceptual definition for management are: (1) definition of the operational requirement, (2) development and evaluation of new concepts and techniques, (3) study of tradeoffs, (4) definition of performance goals and interfaces, and (5) systems management--the art of tying the whole thing together. The article contains a general discussion about: systems and subsystems, basic concepts and ideas of SE, terms common to SE, objectives for SE, and SE implementation and management. SE, properly applied and implemented, will give management the best opportunity to manage technical programs with maximum visibility, and when coupled with schedules, cost, and risk inputs, can become as close as possible to optimum management. (USBR)
W71-05918

WATER RESOURCES SYSTEMS ANALYSIS OF DISCRETE DIFFERENTIAL DYNAMIC PROGRAMMING,
Illinois Univ., Urbana. Dept. of Civil Engineering.
M. Heidari, V. T. Chow, and D. D. Meredith.
Civil Engineering Studies, Hydraulic Engineering Series, No 24, (UILU-ENG-71-2008), January 1971. 118 p, 15 tab, 21 fig, 30 ref, 2 append. OWRR Report B-030-ILL (4).

Descriptors: *Systems analysis, *Optimization, *Dynamic programming, *Planning, Reservoirs, Irrigation, Hydroelectric power, Invertible systems.

The optimization of operating policies of multiple-unit and multiple-purpose water resources systems by traditional dynamic programming with the use of high-speed digital computers encounters two major difficulties: excessive memory requirements, and tremendous amounts of computer time requirements. This report describes an iterative method named discrete differential dynamic programming (DDDP) which can ease the above difficulties considerably. The method starts with a trial trajectory satisfying a specific set of initial and final conditions and applies Bellman's recursive equation in the neighborhood of this trajectory. At the end of each iteration step a locally improved trajectory is obtained and used as the trial trajectory in the next step. It is shown that the method is particularly effective in the case of so called 'invertible' systems. The merits of the proposed approach are demonstrated through its application to two four-unit, two-purpose water resources systems. To save computer time the examples are restricted to deterministic hydrologic inputs.
W71-05922

A PROGRAMMING MODEL FOR FARM IRRIGATION SYSTEMS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03F.
W71-05923

A MODEL OF PUBLIC DECISIONS ILLUSTRATED BY A WATER POLLUTION POLICY PROBLEM,
Resources for the Future Inc., Washington, D.C.
Robert Dorfman, and Henry P. Jacoby.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 173-231, 1970.

Descriptors: *Decisionmaking, *Water pollution, *Mathematical studies, *Water quality, *Cost benefit analysis, Optimization, Data, Management, Government, Rivers, Sewage, Costs, Technology, Taxes.
Identifiers: *Pareto optimality, *Political decision process, Linear programming, Canneries.

This article attempts to present a complicated problem of government decision-making in terms of a formal model. The hypothetical case devised for this purpose incorporated many of the salient features of real water pollution control problems

including a wide variety of hydrologic, technical, social, political and economic issues. Deep seated conflicts of interests among the participants was also incorporated. The model was implemented and provided intelligible results. The model utilized such data as became available and then provided a method of analyzing the way different assumptions would affect various plans likely to be adopted by the decision-making commission. It incorporated information about the commission and also provided a framework for predicting political judgments about the various possible decisions. The model is readily applicable to the circumstances of the assumption which it was based, namely that a water pollution control commission is responsive to the wishes of its constituency. The mathematical analysis presented in this article is designed to be of assistance in understanding and facilitating the lengthier and more cumbersome decision-making processes in current use. (Murphy-Rutgers)
W71-05939

STREAMFLOW SYNTHESIS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 04A.
W71-05946

QUANTITATIVE ANALYSIS IN PUBLIC FINANCE,
York Univ. (England).
Alan T. Peacock.
New York, Praeger Publishers, 266 p, 1969.

Descriptors: *Economic efficiency, *Cost-benefit analysis, *Mathematical studies, Decisionmaking, Taxes, Statistics, Budgets, Forecasting, Fishing, Income, Time, Social aspects, Surveys.
Identifiers: *Quantitative analysis, *Public finance, *Quality problems, *Econometric analysis.

This book consists of a series of studies of the various aspects of quantitative analysis. The studies presented offer a useful concept of the whole area of quantitative analysis to economists generally, and especially to researchers in the field of public water resources. Areas treated in the book are survey research, statistical measures, cost-benefit analysis, measuring efficiency, econometrics of taxation, budget effects and fiscal performance in developing countries. Each topic is presented and then analyzed for both strengths and weaknesses. Practical suggestions are offered for the successful use of quantitative analysis in intelligent policy-making. Four areas requiring improvement are cited; namely, the theory of incidence and application of cost-benefit studies, the development of data on measures linking policy to endogenous economic response, experimental design, and linkages between model-building and policy-making. (See also W71-05948) (Murphy-Rutgers)
W71-05947

OPTIMIZATION TECHNIQUES FOR WATER RESOURCE SYSTEMS,
Washington State Water Research Center, Pullman.
David L. Schreiber
Washington State University, State of Washington Water Research Center, Open-File Report No 6, November 15, 1968. 48 p, 4 fig, 21 ref

Descriptors: *Engineering education, *Water management (Applied), *Model studies, *Computer models, Computer programs, Economics, Washington, California, Sampling, Data processing, Reservoirs, Water quality control, Simulation analysis, Hydrologic aspects.
Identifiers: *Water resources systems engineering, University of California at Los Angeles, Program of study, Water systems, Washington State University.

The author attended a short course entitled Optimization Techniques in Planning, Design, and Operation of Water Resource Systems at the University of California at Los Angeles in 1968, and summarizes the topics covered in the course. Linear programming, dynamic programming, and non-linear programming for water resource systems are outlined, along with advantages and disadvantages, hydrologic system models, methods of simulation, and water quality control programs. Multi-purpose water systems, supply and demand, and cost factors are summarized. On the basis of his other water resources background and what he learned in this course, the author outlines the current program of study available to a Water System Engineering major presently at UCLA; and after listing the related courses currently offered at Washington State University, suggests inclusion there of a graduate-level course entitled Water Resources Systems Engineering. (Yensen - Arizona)
W71-06062

WATER QUALITY MODELING AND PREDICTION,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 05G.
W71-06186

GRANTS FOR PREPARATION OF COMPREHENSIVE AREA PLANS FOR WATER AND SEWER SYSTEMS.
Department of Agriculture, Washington, D.C.

Code of Federal Regulations, Title 7, Chap XVIII, secs 1823.61 thru 1823.70 (1970). 4 p.

Descriptors: *Rural areas, *Grants, *Sewerage, *Water supply, Government finances, Economics, Financing, Financial analysis, Governments, Federal government, Government supports, Allotments, Capital, Capital supply, Credit, Water resources development, Water policy, Sewage treatment, Sewage disposal, Waste disposal, Wastes Waste treatment, Water management (Applied), Planning.

The Secretary of Agriculture promulgates herein rules governing issuance of grants for preparation of comprehensive area plans dealing with water and sewer systems in rural areas. These regulations explain the following: (1) objectives of grants, (2) eligibility for grants, (3) expected content and purposes of grants, (4) technical and professional assistance for planning, and (5) procedures for processing applications for grants. State directors are authorized to approve comprehensive water and sewer planning grants when the amount of the grant does not exceed $5,000. County supervisors will supervise and service each grant to insure that the conditions of the grant are being fulfilled. (Robinson-Florida)
W71-06284

SIMULATION OF RUNOFF FROM URBAN WATERSHEDS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.
W71-06306

OPERATIONS RESEARCH STUDY OF WATER RESOURCES - PART II,
Arizona Univ., Tuscon. Dept. of Hydrology and Water Resources.
Chester C. Kisiel, and Lucien Duckstein.
Water Resources Bulletin, Vol 6, No 6, p 857-867, December 1970. 4 fig, 2 tab, 11 ref.

Descriptors: *Water resources, *Water resources development, *Methodology, *Planning, *Operations research, *Mathematical models, Systems analysis, Model studies, Data processing, Pricing.
Identifiers: *Tuscon basin, *Arizona, Pricing policies, Management models, Multiple linear regression, Discrete convolution relation.

Applications of systems methodology to water problems of the Tuscon basin are summarized. Natural recharge is estimated by means of a discrete convolution relation in which the unit impulse response of an aquifer is derived from basic hydro-dynamic laws. A temporal model of sequences of wet and dry periods during the summer thunderstorm season is based on a multiple linear regression equation that relates total rainfall amount during the wet period to the duration of the wet period and volume of peak rainfall. A spatial model predicts point rainfall frequency of maximal and minimal amounts of thunderstorm rainfall. A static management model allocates Tuscon groundwater, Avra Valley water, Colorado River water, and reclaimed waste water to municipal, industrial, and agricultural users within a pricing framework. For a range of pricing policies the model clearly demonstrates the opportunity costs to the community by use of higher-priced water supplies such as Colorado River water in lieu of Tuscon groundwater. The role of worth of data studies in relation to data analysis, model building and management studies is also introduced. (Davis-Chicago)
W71-06307

MODELING AND CONTROL OF THE POLLUTION OF WATER RESOURCES SYSTEMS VIA MULTILEVEL APPROACH,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
Yacov Y. Haimes.
Water Resources Bulletin, Vol 7, No 1, p 93-101, February 1971. 2 fig, 16 ref.

Descriptors: *Model studies, *Water pollution, *Water pollution control, Optimization, Mathematical models, Water resources.
Identifiers: *Water resource systems, *Multilevel optimization, Lagrange multipliers.

The problem of modeling and control of water pollution is considered. A general mathematical model, where the pollution effluent is discharged directly into the lake, or into a bypass pipe leading to an advanced Waste Water Treatment (AWT) plant, is developed. The Water resource System (WRS) under consideration is decomposed into N subsystems. The pollution effluent imput vector to each subsystem includes the water quantity and different water characteristics such as BOD, DO, pH, conductivity, temperature, algae, phosphates, nitrates, etc. Treatment cost functions and quality transition functions as well as system model constraints are introduced, where all functions can be nonlinear. A system Lagrangian is formed to incorporate the system constraints and coupling. The Lagrangian is decomposed into N independent subsystems, and a two level optimization methodology is introduced. Each subsystem is independently and separately minimized at the first level assuming known Lagrange multipliers using optimal values for effluent inputs from all subsystems obtained from the first level. Economic interpretation on the Lagrange multipliers reveals that they are merely prices imposed by the central authority (second level) for the pollution caused by the subsystems. Advantages of the multilevel approach are discussed. (Davis-Chicago)
W71-06311

6B. Evaluation Process

DEVELOPMENT OF WATER RESOURCES IN ASIA AND THE FAR EAST-REPORT OF THE NINTH SESSION OF THE BIENNIAL REGIONAL CONFERENCE ON WATER RESOURCES DEVELOPMENT.
Economic Commission for Asia and the Far East (UN), New York.

Water Resources Journal, Economic Commission for Asia and the Far East (ST/ECAFE/SER.C/86) p 45-76, September 1970. 32 p, 49 ref.

Descriptors: *Conferences, *Water resources development, *Foreign countries, *Reviews, Irrigation, Flood control, Soil conservation, Reclama-

ion, Drainage, Surface waters, Agriculture, Projects, Planning, Costs, Evaluation, United Nations, Watershed management.
Identifiers: *Bangkok (Thailand).

The conference proceedings of the Water Resources Development of the secretariat of the United Nations Economic Commission for Asia and the Far East (ECAFE) held at Bangkok, Thailand, September 28 to October 5, 1970 are summarized under the following main agenda items: Biennial review of water resources development in the countries of the ECAFE region in relation to irrigation, reclamation and drainage, flood control and soil conservation costs, 1969-1970; Scope of water resources development to meet the food requirements of the ECAFE region during the next two decades; Achievement of goals subsequent to project construction: Efficiency in water resources project management and water use; and long-term requirements in water resources development in relation to the world-wide strategy of the second United Nations Development Decade. (Woodard-USGS)
W71-05864

WATER RESOURCES DEVELOPMENT IN LAOS.
Economic Commission for Asia and the Far East (UN), New York.

Water Resources Journal, United Nations Economic Commission for Asia and the Far East (ST/ECAFE/SER.C/86), p 1-44, September 1970. 44 p, 19 fig, 11 tab.

Descriptors: *Water resources development, *Surface waters, *Hydrologic data, Water supply, Water utilization, Projects, Powerplants, Irrigation, Navigation, Flood control, Costs, Foreign countries, Evaluation, United Nations.
Identifiers: *Laos.

Water resources projects in Laos concerning surface water supply, dams, reservoirs, powerplants, irrigation, navigation, flood control, and costs are discussed and hydrologic data tabulated. The Mekong river is one of the great rivers of the world. At the China-Laos-Burma border tripoint, the Mekong leaves China, and flows for 205 km between Burma and Laos, forming their border. Having entered its lower basin, the river begins its eastward swing. From this point to the Mekong-Nam Ou confluence close to the town of Luang Prabang, the river cuts obliquely across the major geological structures with the main tributaries and drainage area located in Laos on the left bank, looking downstream. From the Mekong-Nam Ou confluence, the river makes another abrupt change of course. It turns southward for 250 km through a complex geological zone of igneous and sedimentary rocks. The climate of Laos is marked by two distinct seasons, the wet season lasting from May to October, and the dry season extending from November to April. The average rainfall for the year lies in the 1,300 to 2,300 mm range depending on location. The average annual temperature ranges between 18.5 degrees and 32 degrees C according to latitude and elevation. (Woodard-USGS)
W71-05865

SOCIO-CULTURAL IMPACTS OF WATER RESOURCE DEVELOPMENT IN THE SANTIAM RIVER BASIN,
Oregon State Univ., Corvallis. Water Resources Research Inst.
Thomas C. Hogg, and Courtland L. Smith.
Available from NTIS as PB-198 044, $3.00 in paper copy, $0.95 in microfiche. Oregn Water Resources Research Institute Report WRRI-5, October 1970. 133 p, 9 tab, 10 fig, 65 ref. OWRR Project B-011-ORE (1).

Descriptors: Water resource development, Dams, *Social aspects, Technology, *Planning, Reservoirs, Data collection, Recreation, Population, Income, Benefits, Environment, *Psychological aspects, *Attitudes, Oregon, *Sound impact.
Identifiers: *Socio-cultural system, Social accounting, Economic development, *Santiam River Basin.

The effects of two dams on the behavioral and attitudinal patterns of Santiam residents are studied. The development of the dams from preconstruction through construction to postconstruction provided the background for the environmental and technical changes being studied. Data on these changes in relation to the local socio-cultural system were gathered both by standard research methods and special anthropological techniques. The degree of acceptance of the water system to innovation and change was found to be related to the position of the observer in the socio-cultural system and the relation of larger similar systems. Lack of articulation and planning between various elements of the larger socio-cultural system restricts full development of benefits. Full benefits in the total water resource development process were found to be dependent on seeking consumer values and actions as inputs in the process, thus calling for the added dimension of social accounting in all phases of water. (Murphy-Rutgers)
W71-05921

STRATEGIES FOR ENVIRONMENTAL MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
Public Policy, Vol XIX, No 1, p 37-52, Winter 1971.

Descriptors: *Water pollution control, Resource allocation, Economic efficiency, Waste treatment, Water quality.
Identifiers: *Environmental management, Externality, Recycling, Subsidy, Effluent charge, Social cost, Regional management.

This article suggests that present environmental pollution problems are primarily the result of failures in the system of economic incentives. The example of residuals from production and consumption of resources is given to stress the need for an efficient approach to the management of congestion. The present federal subsidy-enforcement strategy toward water pollution control is criticized as ineffective and an alternative approach is outlined. This approach has two elements: the waste discharger must bear the costs of damage of his waste disposal activities through effluent charges; pollution problems should be handled through water quality management on a regional basis. The author suggests the effluent charge be on a national basis with regional agencies able to exceed the minimum, if necessary. It is hoped that federal leadership in the implementation of this proposal will lead to effective and efficient water quality management. (Siegenthaler-Rutgers)
W71-05935

WATER POLLUTION CONTROL, RIVER BASIN AUTHORITIES AND ECONOMIC INCENTIVES: SOME CURRENT POLICY ISSUES,
Bowdoin Coll., Brunswick, Maine; and Wisconsin Univ., Madison.
A. Myrick Freeman, and Robert H. Haveman.
Public Policy, Vol XIX, No 1, p 53-74, Winter 1971.

Descriptors: *Water pollution control, *Water quality, River basin commission, Resource allocation, Decision-making, Marginal cost, Economic evaluation, Municipal waste.
Identifiers: *Effluent charge, User charge, Subsidy.

This article examines policy alternatives to the current enforcement-subsidy approach to the improvement of water quality. These proposals emphasize comprehensive river basin planning and water quality management and stress economic incentives, prices and charges, as a means of reducing the output of industrial and municipal wastes. These proposals are used to illustrate the scope of the river basin authority, its powers and functions, the effects of Federal cost-sharing and the river basin authority as a political institution. The author then presents his own proposal for the reform of Federal policy through the establishment of a single experimental water basin authority based on the consolidations of existing agencies responsible for air, land, and water quality in a particular region. This authority would minimize reliance on legal enforcement and stress the use of economic incentives such as user and effluent charges. This approach would yield information on the effectiveness of the regional approach to environmental management and the ability of economic incentives to reduce waste generation at relatively low cost. (Siegenthaler-Rutgers)
W71-05937

OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Arlington, Va.
Edwin L. Johnson.
In: Evaluation Processes in Water Resources Planning, Urbana, Illinois, American Water Resources Association, p 41-57, July 1970.

Descriptors: *Water pollution control, Optimization, Budget constraint, Cost-benefit analysis, Economic efficiency, Secondary treatment, Water quality, Systems analysis.
Identifiers: *Suboptimization, Objective function, Cost effectiveness.

This paper considers the operationalization of optimum investment in water pollution control. Current attempts at optimization result in suboptimization of costs because interrelations among air, water, and solid wastes are not treated. Investment is optimized subject to the secondary treatment and anti-degradation restrictions set by water quality standards. Within the context of water quality standards, the objective function tends to be characterized by constrained cost effectiveness. Recent research has questioned the basis upon which water quality plans are prepared and hence disturbed the predicted relation between pollution abatement and environmental quality. Inadequate implementation by institutions of plans for water pollution control is another obstruction to optimum investment. The author concludes that the major research areas for optimization are economic evaluation, reform of political and governmental institutions, development of means of measuring social preference and then introducing these into the systems analysis part of investment optimization. (Siegenthaler-Rutgers)
W71-05938

ECONOMIC ANALYSIS IN NATURAL RESOURCE PROGRAMS,
George Washington Univ., Washington, D.C.
Jack L. Knetsch.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 562-579, 1970.

Descriptors: *Economic analysis, *Natural resources, *Government, *Water resource development, *Cost benefit analysis, Flood control, Navigation, Irrigation, Budgets, Water supply, Pollution, Planning, Economic efficiency.
Identifiers: *Public expenditures, Resource allocation, Market incentives.

This article surveys several points pertinent to efforts to improve public expenditure decisions in natural resource programs, especially as related to relevant information and decision tools. Specific topics treated include the changing concerns of natural resource programs, and a sketch of how analytical guides for public expenditures resemble the market allocation of resources. Market incentives may be used increasingly to set priorities in public provision of resource services. The weakness of demand information is cited, along with the consequent effects on rationalizing expenditure

decisions. Finally, an outline is presented of some problems caused by the increasingly important values associated with natural resources largely beyond present quantification methods. A warning is given about the various viewpoints of the results of natural resource programs and an assessment of their efforts. The success of explicit cost-benefit analysis in the past in such areas as water development expenditures is acknowledged, along with the need for the extension of such methods in present applications and the need for greater flows of information to achieve desired investment and allocation guides in this (and others) natural resource areas. (Murphy-Rutgers)
W71-05940

ENVIRONMENTAL QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Blair T. Bower, and Walter Spoffard.
Natural Resources Journal, Vol 10, No 4, p 655-667, October 1970.

Descriptors: *Technology, *Water pollution, *Air pollution, *Environmental quality, Investment, Water supply, Reservoirs, Water treatment, Water courses, Agriculture, Irrigation, Pesticides, Streamflow, River basins, Effluents, Aeration.
Identifiers: *Material residuals, *Energy residuals, Receptors, Air filters.

This article focuses on those aspects of environmental quality affected by the material and energy residuals generated in man's activities and on those aspects of environmental quality directly affected by production and consumption activities where no residuals are involved. The residuals-environmental quality system is described as a composite of the economic-technologic-ecologic subsystem and the information-response-institution-management subsystem. The elements of the system are tied together by the three flows of material, energy and information. Both the material and energy residuals may be transported through, or deposited in or on, the three environmental media of air, water and land. Water is also discussed in its functions as a storage for residuals and as a receptor for ultimate residual concentrations, along with other elements of the natural environment. The article suggests that environmental quality may be maintained and/or improved through various methods of residuals management. Four measures suggested are the reduction of residuals generation, the modification of residuals after generation, better utilization of the assimilative capacity of the environment, and application of final protective measures. This article is germane to environmental quality management decision-making and particularly as it applies to the water resource area. (Murphy-Rutgers)
W71-05941

URBAN PLANNING ASPECTS OF WATER POLLUTION CONTROL,
Columbia Univ., New York.
Sigurd Grava.
New York, Columbia University Press, 223 p, 1969

Descriptors: *Water pollution, Watershed management, Waste disposal, Systems analysis, Treatment facilities, Decision making, Cost-benefit analysis, Resource allocation, Simulation.
Identifiers: *Urban planning, Collection network, Recycling

This book considers the various techniques and methods available in water pollution control and their role in community planning. The sources of pollution, treatment systems along with related financial and administrative considerations are discussed to provide background material in the planning for waste control. The author analyzes water pollution problems within the context of the entire watershed basin and formulates a model relating pollution control and waste management to local economic and ecological considerations. This analysis provides the basis for cost-benefit analysis of a particular watershed. The planning organization for watershed or community pollution control systems requires the formulation of objectives, translation of objectives to guidelines and standards, plan preparation and evaluation along with means of plan execution. The influence of population density and settlement patterns also affect waste management planning for communities. (Siegenthaler-Rutgers)
W71-05944

THE 'PROBLEM SHED' AS A UNIT FOR ENVIRONMENTAL CONTROL,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
Archives of Environmental Health, Vol 16, No 1, p 124-127, January 1968.

Descriptors: *Water quality, Watershed, Decision-making, Economies of scale, Resource allocation, Economic efficiency, Effluent charge, Systems analysis.
Identifiers: *Problem shed, Externality, Indivisibility, Market failure, Decreasing costs, Environmental control.

This paper considers the role of externalities and indivisibilities in the selection of a problem shed as a unit of environmental planning and control. An example is given of industrial waste discharges that impose external costs on downstream municipal water treatment facilities. Economic efficiency requires that an administrative agency or problem shed be formed to reduce the waste discharge through the imposition of an effluent charge on the waste discharger. The problem shed should be of appropriate size in order to internalize externalities and efficiently manage environmental problems by large scale regional measures. The problem shed is used in research on water quality management but the opposition of local jurisdictions has retarded the implementation of this concept as an administrative agency. (Siegenthaler-Rutgers)
W71-05945

REGIONAL PLANNING,
North Carolina Univ., Chapel Hill.
Maynard Hufschmidt.
New York, Praeger, 1969. 396 p.

Descriptors: *Planning, Cost-benefit analysis, Decision making, Resource allocation, Flood control.
Identifiers: *Regional planning, Objective function, Environmental planning, Economic growth.

This book considers the relationship between regional planning and associated planning fields. The topics considered are regional planning as a field, environmental planning, natural resources planning, planning for community and human resources and planning for economic development. The papers included stress both the theoretical and practical aspects of planning and decision making. The economic context as well as the political institutional context is stressed in plan implementation. The limitations of cost-benefit analysis are noted and the need for broader socioeconomic objectives is mentioned. The discussion of cost benefit analysis and environmental planning make this book relevant to applied water studies. (See also W71-05950) (Siegenthaler-Rutgers)
W71-05949

COMPREHENSIVE ENVIRONMENTAL PLANNING,
Clark Univ., Worcester, Mass.
Robert Kates.
In: Regional Planning, New York, Praeger, p 67-87, 1969.

Descriptors: *Water resource planning, Water pollution, Air pollution, Flood control, Economic value, Economic evaluation, Cost-benefit analysis, Design criteria.
Identifiers: *Investment decision, Objective function, Matrix.

This essay examines the present scope of environmental planning and identifies some unique aspects of environmental planning within the framework of the investment decision model. The author finds environmental planning similar to water resource planning in the 1930's and to the multipurpose nature of present water resource development. The objectives of individual programs for environmental planning are prevention of sickness, aesthetic stimulation of the senses, and economic value. However, these objectives serve as constraints in an investment decision model. The author also discusses the difficulty of relating the objectives of environmental planning such as economic growth to design criteria and science. The applicability of utility theory, stimulation, and political decision-making is considered for environmental planning. (See also W71-05949) (Siegenthaler-Rutgers)
W71-05950

PESTICIDE RESIDUES AND ENVIRONMENTAL ECONOMICS,
Florida Univ., Gainesville; and Missouri Univ., Columbia.
For primary bibliographic entry see Field 05G.
W71-05951

INFORMATION FOR DECISION MAKING,
Northwestern Univ., Evanston, Ill.
Alfred Rappaport.
Englewood Cliffs, Prentice-Hall, Inc., 447 p, 1970.

Descriptors: *Decision making, Risk, Linear programming, Cost, Regression analysis.
Identifiers: *Capital budgeting, Information technology.

This book contains a series of essays that relate advances in the management sciences and behavioral sciences to the task of effectively designing and using decision-oriented information systems. The role of models in decision-oriented information systems is outlined with problems of implementation and extensions discussed. Methods of dealing with uncertainty of planning and control variables are discussed with several applications given in capital budgeting and linear programming. The impact of information on decisions and performance is considered. The central theme of this book centers on the issues of decision making and accordingly, this is relevant material for water investment studies. (See also W71-05954 and W71-05955) (Siegenthaler-Rutgers)
W71-05953

UNCERTAINTY AND ITS EFFECT ON CAPITAL INVESTMENT ANALYSIS,
Kentucky Univ., Lexington.
Martin B. Solomon.
In: Information for Decision Making, Englewood Cliffs, Prentice-Hall, p 278-283, 1970.

Descriptors: *Project feasibility, Risk, Economic evaluation, Interest rate, Cost, Discount rate.
Identifiers: *Capital budgeting, Sensitivity analysis, Payback period, Present value, Estimation error.

One aspect of capital budgeting is considered, namely, the application of theoretically correct criteria such as present value and discounted rate of return to actual investment decisions. The author contends that these theoretically correct choice criteria have limited practical value when uncertainty is present with respect to cost, revenues and project life. To illustrate this contention, investments with constant annual returns and those with declining annual returns are considered. The results of the sensitivity analysis indicate that relatively small overestimates and underestimates create large errors in the discounted rate of return. For investment decisions characterized by a large amount of uncertainty, the payback criterion can provide results superior to the present value and discounted rate of return methods for project evaluation. This article is relevant to water resources studies concerned with capital budgeting and decision making. (See also W71-05953) (Siegenthaler-Rutgers)

W71-05954

SENSITIVITY ANALYSIS IN DECISION MAKING,
Northwestern Univ., Evanston, Ill.
Alfred Rappaport.
In: Information for Decision Making, Englewood Cliffs, Prentice-Hall, p 174-190, 1970.

Descriptors: *Decision making, Risk, Resource allocation, Linear programming, Operations research, Optimization.
Identifiers: *Sensitivity analysis, Objective function, Information decision, Decision theory.

The applicability of sensitivity analysis to decision making under risk is considered. Sensitivity analysis tests the responsiveness of model results to changes in parameter values and offers information for appraising the relative risk among alternative courses of action. This method is applicable to operating decisions and provides guidelines for allocating organizational resources to data collection activities as well. Applications of sensitivity analysis to both operating and information decisions are presented. The author uses a linear programming model to illustrate the risk analysis and information economics applications of sensitivity analysis. The relationship between sensitivity analysis and the statistical decision theory approach to information decisions is outlined. This essay is relevant to water studies concerned with the role of uncertainty in project evaluation. (See also W71-05953) (Siegenthaler-Rutgers)
W71-05955

MEASURING EFFICIENCY IN GOVERNMENT SERVICES,
York Univ. (England).
J. P. Hutton.
In: Quantitative Analysis in Public Finance, New York, Praeger Publishers, p 91-109, 1969.

Descriptors: *Economic efficiency, *Government, *Resource allocation, *Cost-benefit analysis, Sewage, Social aspects, Management, Transportation, Technology.
Identifiers: *Productivity, *Input-output analysis, Growth, Employment, Stability, Price, Scarcity.

This paper discusses various aspects of the measurement of efficiency in government services, indicating the problems associated with measuring the aggregate productivity despite the accepted infrastructure of roads, sewage and water, police, and the like. The process of measuring such productivity is likened to retrospective cost benefit analysis. The notions of efficiency under various titles such as price, technical, overall, and managerial efficiency are dealt with in their relation to decision-making in resource or service areas. Some techniques of analysis are surveyed in both state and local government contexts, citing the particular difficulties of measuring quality in productivity. Various resources are used as examples of what to expect in an optimal resource allocation situation. The problems of administration and data are also discussed, following which G. Hauser comments on the entire efficiency problem. This article is particularly relevant to issues in allocation difficulties and is consequently valuable to water resource researchers. (Murphy-Rutgers)
W71-05957

THE ROLE OF INCENTIVES, PENALTIES, AND REWARDS IN ATTAINING EFFECTIVE POLICY,
Brookings Institution, Washington, D.C.
Charles L. Schultze.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 145-172, 1970.

Descriptors: *Decision making, *Water pollution, Natural resource allocation, *Government, Investment, Budgets, Flood control, Waste treatment, Dams, Sewers, Effluents, Taxes.
Identifiers: *Incentives, *Public expenditure policy, Program design, Program execution.

The problem of incentives in the formulation of public expenditure policy is surveyed. This problem arises because such decision-making results from the joint action of many independent decision-makers, and the fact that public programs are increasing rapidly in both scope and complexity, embracing such matters as urban rehabilitation, air and water pollution control, and development of depressed areas. The problem of incentives is regarded as an aspect of social behavior to be considered at every stage of public policy formulation, including formation of objectives, program design and resource allocation. The various types of incentives which appear relevant in such policy formulation are treated and include incentives which result in rechanneling actions towards greater efficiency. Finally, some of the theoretical and political problems which arrive in applying incentive concepts to public expenditure programs are discussed. This article is relevant to those interested in the maximization of federal investment programs involving resource allocation. (Murphy-Rutgers)
W71-05959

INSTITUTIONAL OBSTACLES TO REALLOCATING GOVERNMENT EXPENDITURES,
Washington Univ., St. Louis, Mo.
Murray L. Weidenbaum.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 232-245, 1970.

Descriptors: *Cost-benefit analysis, *Government, *Welfare economics, *Resource allocation, Social aspects, Budgets, Taxes, Investment, Financing, Decisionmaking.
Identifiers: *Institutional obstacles, Fixed charges, Controllability, Social insurance, Policy decisions.

This article considers the major obstacles to making improvements in allocating public resources operational, with special attention to those constraints that limit the discretion of governmental policymakers. This goal is achieved through a study of the techniques of governmental budgeting which highlights the substantive issues involved in the allocation of government resources. The basic explanation is presented in terms of the differences in the relative controllability, the appropriations review process, and the different types of government spending programs. Among the changes proposed to reduce institutional obstacles to effective resource allocation are a review of the necessity for numerous established trust funds, a reevaluation of the need for various permanent and indefinite appropriations, a reexamination of the 'fixed charges' on the budget, and a greater focus on the new starts of construction and other long term projects. The content of this article holds particular interest to those concerned with the allocative efficiency of government water resource investment. (Murphy-Rutgers)
W71-05961

PROJECT DESIGN AND EVALUATION WITH MULTIPLE OBJECTIVES,
Bowdoin Coll., Brunswick, Maine.
A. Myrick Freeman, III.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 347-363, 1970.

Descriptors: *Decision-making, *Cost-benefit analysis, *Economic efficiency, Flood control, Transportation, Spillover, Wastes, Municipal water, Income.
Identifiers: *Multiple objectives, *Public expenditures, *Weighting functions, Externalities, Valuation techniques, Constraints.

The problem of allocating limited government budgets among competing programs is surveyed. The problem is basically one of valuation; namely, assigning meaningful prices to all benefits. It is also indicated that choice among different kinds of benefits is unavoidable in the (either/or) allocation procedure under discussion and that a one-to-one relationship exists between the choices and relative values for different benefits. When values are not generated by market behavior, it is suggested that values be considered in the form of explicit weighting or social welfare functions for decision-making purposes, although such weighting functions cannot be inferred from observed choices among public expenditure programs. It is proposed that such functions should be based on consideration of legislative intent, guidelines in law and precedent, and subjective evaluations by politically responsive decision-makers. All these procedures are most likely to be successful if the initiative comes from executive agencies and is used in areas of established programs and repeated decisions. These criteria make the proposed design and evaluation methods of benefit estimation especially relevant to the water area. (Murphy-Rutgers)
W71-05962

THE ABSENCE OF KNOWLEDGE OF DISTRIBUTIONAL IMPACTS: AN OBSTACLE TO EFFECTIVE POLICY ANALYSIS AND DECISIONS,
Michigan State Univ., East Lansing.
James T. Bonren.
In: Public Expenditures and Policy Analysis Chicago, Markham Publishing Company, p 246-270, 1970.

Descriptors: *Water resource development, *Government, *Cost-benefit analysis, Capital costs, Investment, Decision-making, Social aspects, Taxes, Income, Irrigation, Statistics.
Identifiers: *Distributional impacts, *Public programs, *Higher education, *Farm program.

The distributional consequences of public decisions have major and increasingly important impacts in our society. Little is known about the distributional impacts of public programs, the social processes by which such impacts are institutionalized, or how to redesign distributional systems without incurring excessive political or social costs. It is proposed that increased efforts to obtain data for program analysis of the distributional impacts of public decisions is prerequisite to the desired efficiency of such decision-making and the integrity of public commitments in equity. Examples of education, water resource development, and the farm program are utilized in indicating the many unintended consequences which may result from public decisions in which no data had been systematically collected on distributional impacts. Working from the objectives given in the article, past decisions in the three areas cited are pointed out as lacking in economic and social wisdom. (Murphy-Rutgers)
W71-05963

EXTERNALITIES, INFORMATION AND ALTERNATIVE COLLECTIVE ACTION,
Northwestern Univ., Evanston, Ill.; and Carnegie-Mellon Univ., Pittsburgh, Pa.
Otto Davis, and Morton Kamien.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 74-95, 1970.

Descriptors: *Cost-benefit analysis, *Technology, *Optimization, Natural resource development, Water pollution, Sewage, Capital, Costs, Fishing, Government, Taxes, Social aspects.
Identifiers: *Externalities, *Pareto optimality, Collective action, Welfare economics, Information.

This article amplifies the major conclusion of modern welfare economics which can be viewed as a theorem concerning the allocation of resources by a market mechanism. Particular attention is given to the basic assumptions underlying this theorem. The criterion, the market and optimality are discussed as are problems associated with externalities. Various possible solutions are discussed

in terms of their potential effectiveness. Some of these are solutions by prohibition, directive, voluntary action, taxes and subsidies, regulation, payment, or action. These are all presented to deal with problems of technological externalities. It is proposed that the tools of cost benefit analysis provide the proper perspective for a policymaker attempting to attain an acceptable allocation of limited resources, such as water. (Murphy-Rutgers)
W71-05964

THE TREATMENT OF RISK AND UNCERTAINTY,
California Univ., Los Angeles.
Jack Hirsbleifer, and David Shapiro.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 291-313, 1970.

Descriptors: *Risk, *Uncertainty, *Cost-benefit analysis, Economic efficiency, Income, Investment, Government, Technology, Decision-making, Costs, Social aspects, Prices, Taxes, Pooling.
Identifiers: *Certainty-equivalent value, *Time-state preference, Externalities, Expected value, Risk aversion, Time preference, Market equilibrium.

Risk and uncertainty in the analysis of public investment decisions is considered. The analysis is discussed within the framework of cost-benefit principles, the efficiency criterion and dollar values reduction. Risk is considered as a suggestion of the potential variability of the objective configuration of events, while uncertainty labels the subjective lack of knowledge about the configuration results. Risk is considered both as a concept of expected value and as a concept of the certainty-equivalence value of an uncertain outcome in government decision making. A riskless case is presented, and a review is made of risk-aversion literature on cost-benefit analysis for public investment decisions. Past and present government practices are surveyed to indicate the wide variety of decision rationales. The model of time-state preference is shown as a theoretical advance in the direction of an exact theory of risk, leading to the present certainty-equivalent value criterion as a generalization of present value criterion applicable. This article should be of use as a review and extension of the analysis of risk and uncertainty for water resource investment decision-making. (Murphy-Rutgers)
W71-05965

RESCUING POLICY ANALYSIS FROM PPBS,
California Univ., Berkeley.
Aaron Wildavsky.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 461-481, 1970.

Descriptors: *Cost-benefit analysis, *Decision-making, *Planning, *Budgeting, Government, Risk, Health, Economic efficiency, Income.
Identifiers: *Policy analysis, *PPBS, Incentives, Inertia, Creativity, Defense.

Aspects of providing the information which contributes to politically and socially relevant decision-making are considered. This is achieved through evaluation of alternative means and ends in pursuit of suitable policy recommendations and through the sustained application of intelligence and knowledge to social problems. This article proposes that the traditional planning-programming-budgeting system has brought great damage to effective policy analysis, citing the special difficulties of inertia, personnel and the lack of trained personnel. In order that policy analysis prospers, the author suggests that top management must desire such analysis and the incentives must be increased for the suppliers of such analysis. The need for reexamination of critical aspects of policy analysis is indicated, citing the example of water resource projects. This article is relevant to those involved in water resources policy analysis. (Murphy-Rutgers)
W71-05968

THE DEMAND FOR LEISURE,
New School for Social Research, New York.
For primary bibliographic entry see Field 06D.
W71-05970

INSTITUTIONAL FACTORS INFLUENCING WATER DEVELOPMENT IN TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
Warren L. Trock.
Available from NTIS as PB-198 090, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Report No TR-35, March 1971, 35 p, 6 tab, 37 ref. OWRR Project B-025 TEX (7).

Descriptors: *Institutions, *Planning, Irrigation, *Water rights, *Irrigation districts, *Interbasin transfers, Cost sharing, Water law, Water administration, *Districts, *Texas.

Attention has been given to institutions which are important to (1) the implementation of the Texas Water Plan, and (2) the efficient use of water resources in irrigation in the lower Rio Grande Valley. Numerous political and economic institutions must be changed or newly developed to provide for (1) the interbasin diversions proposed by the Texas Water Plan, (2) the creation and management of transfer systems and (3) distribution of water within importing areas and fulfillment of financial obligations. These will be expressed by individuals and groups various points of view relative to water developments and the administration of water supplies. Self interests will be forcefully expressed. Competing users of water will make themselves heard. Institutional arrangements to resolve conflicts, to provide for development of water systems and to insure efficient use of water will be critical to the success of the Plan. Institutions of particular importance to efficient distribution and use of water in irrigation in the lower Rio Grande Valley are the irrigation districts and their policies and operations plus water rights. While operations of districts could significantly be influenced by consolidation of districts, rehabilitation, and changed managerial policies, there are important barriers to such change. Present low costs of water in districts and the desire to maintain control of irrigation systems policies and procedures in local districts may not allow change to take place. Negotiable water rights are a possibility, and exchange of rights or annual allocations would improve efficiency of water use. District members need to be made aware of consequences of such a change in this institution. An informational program relative to water management would be helpful.
W71-05972

RURAL WATER DISTRICTS--HERE IS WHY THEY ARE NEEDED,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
Grant I. Johnson.
Quarterly Serving Farm, Ranch and Home, Spring 1970, Vol 17, No 1, p 20-23.

Descriptors: *Water districts, *Water supply, *Water management (Applied), *Cooperatives, *Rural areas, Exploration, Water wells, Legislation, Water distribution (Applied), Economic impact, Limiting factors, Surface water, Groundwater, Nebraska, Water demand.
Identifiers: *Rural water districts, Pawnee County (Neb), Johnson County (Neb), Richardson County (Neb), Nemaha County (Neb), Semi-arid lands.

Much of a 4-county semi-arid rural area of southeastern Nebraska suffers from limited ground and surface waters, and from highly mineralized groundwater. Pawnee, Johnson, Richardson and Nemaha Counties have been economically damaged as water restricts town, farm and ranch growth. Rural water districts (RWD) may be the solution to this problem. RWD, similar to rural electric districts, will provide water to subscribers, as authorized by the legislature as LB 896 in 19
Preliminary work divides Nemaha County into
water districts which may operate economica
Four more RWDs are being developed. Surveys
dicate county-wide water needs. Of six wells dri
in 1967 from 130 to 250 feet, only 1 produ
water at the rate of 1/4 gallon per min
Economic feasibility studies are needed, and
pendable sources of good quality water require
pensive exploration. Cooperative water-resou
development may be necessary in other water-d
cient areas. (Popkin - Arizona)
W71-06061

**WATERFRONT LAND USE IN THE A
TRALIAN STATE CAPITALS,**
Victoria Univ., (British Columbia). Dept. of Ge
raphy.
Charles N. Forward.
Supported by Canada Council. Association
American Geographers, Annals, Vol 60, No 3
517-532, September 1970. 13 fig, 3 tab, 6 ref.

Descriptors: *Land use, *Cities, *Harbors, Recr
tion, Industrial plants, Ships, Planning, Le
aspects, Social aspects, Land classification, La
development, Zoning, Urbanization, On-site
vestigations.
Identifiers: *Waterfronts, *Australia.

Waterfront land in port cities is subject to a vari
of uses, many of them conflicting. Such land
generally more valuable than that immediately
land, but its significance has not been fully
preciated by urban administrations or planning
partments. Physical aspects and land uses, b
esthetic and economic, were investigated in th
Australian capital cities, Sydney, Melbour
Brisbane, Adelaide, Perth and Hobart. Most of
Australian population lives along a crescent
coastal swath between Brisbane and Adelaide.
are important ports in terms of shipping tonn
handled. Hobart, the capital of Tasmania lies o
side the swath and is the least important in shipp
and population. Adelaide and Perth are both c
tral places for vast arid interiors. Land uses w
mapped according to a standard industrial class
cation to ensure comparability between cit
Although the existence of 2 distinct gro
emerged in terms of harbor land usuage,
distinction could not be accounted for by obvi
variations among cities such as populati
economic functions or waterfront land mileage.
stead, the answer seems to lie in harbor char
teristics. Sydney, Brisbane and Hobart are all
broad estuaries that provide ample waterfr
space, and contiguous land is characterized b
wide variety of uses, including residential are
Melbourne, Adelaide and Perth are several m
from the ocean, on small rivers, and waterfr
land is therefore much more limited. Waterfr
land use is dominated by recreational categor
mainly parks. Planning of waterfront land
should be carried out on a metropolitan basis to
sure rational and efficient utilization of
resource. (Casey - Arizona)
W71-06065

**COMMUNITY FACILITIES PLAN; WAT
AND SEWER PLAN; PUBLIC IMPROVEMEN
PROGRAM AND CAPITAL BUDG
DECHERD, TENNESSEE.**
Dechard Municipal Planning Commission, Tenn

Available from NTIS as PB-195 653, $3.00
paper copy, $0.95 in microfiche. Dechard M
nicipal Planning Commission Report, Feb 1970.
p. HUD Grant Tenn P-119.
Identifiers: *Urban planning, *Tennessee, Edu
tion, Recreation, Fire protection, Police, Pu
utilities, Public health, *Decherd, Tennessee.

The Decherd Community Facilities Plan evalua
the local public facilities in terms of their adequ
to serve the present and projected population
the City. It includes an inventory and analysis of
educational, recreational, protective public wo
health and other community facilities in Decher

W71-06105

NORTH CAROLINA WATER PLAN PROGRESS REPORT CHAPTER 6, RESEARCH (DRAFT).
North Carolina State Dept. of Water and Air Resources, Raleigh.

North Carolina Department of Water and Air Resources Water Plan Progress Report, Chapter 6, December 1970. 75 p, 89 ref. OWRR Project A-999-NC (20).

Descriptors: *Water resources development, *Planning, *Research facilities, *North Carolina, Evaluation, Federal Government, State government, Local governments, Industries, Grants, Administration, Allotments, Water law, Water policy, Programs, Water pollution control, Abatement, Land use, Water demand, Water quality control, Recreation.
Identifiers: *North Carolina Water Plan.

This report is a review draft of chapter 6 which is a part of one of three stages of the overall North Carolina Water Plan. Included in this review are National Assessment of Water Resources Research Needs; Water resources Problems and Research Needs in North Carolina; Water Resources Research in North Carolina Supported by Federal Agencies; Water Resources Research in North Carolina Performed by Federal Agencies; Private Industry Research in North Carolina; State Government Operating Agency Research in North Carolina; Non-Profit Institute Water Research in North Carolina; Water Resources Research Institute; Institute of Government of the University of North Carolina; Office of Marine Sciences; and University Community at Large. A bibliography of published reports of the North Carolina Water Resources Research Institute is included. (Woodard-USGS)
W71-06116

SAFE YIELD OF AQUIFERS: AN ECONOMIC REFORMULATION,
Resources for the Future, Inc., Washington, D.C.
Robert A. Young.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, NoIR 4, p 377-385, December 1970. 9 p, 24 ref.

Descriptors: *Safe yield, *Cost-benefit analysis, *Optimization, Water conservation, Groundwater, Water resources development, Water yield, Water yield improvement, Pumping, Aquifers.
Identifiers: Groundwater resources.

Concepts of safe yield of groundwater reservoirs have been criticized by hydrologists as ambiguous, pseudohydrologic and overly limited in scope. From the perspective of economics, these difficulties stem from application of an essentially descriptive (factual) concept to the prescriptive (normative) problem of resource allocation. From the theory of optimal resource allocation in economics, it is shown that groundwater basin management becomes an issue of public concern because of the existence of technical conditions which prevent the market mechanism from properly functioning in the allocation of groundwater. The rules for allocating groundwater implicit in the prescriptive definition of safe yield are addressed to significant issues, problems which are termed external diseconomies in economics. However, these rules are deficient in that they focus on costs of groundwater withdrawals while ignoring associated benefits. The objective of maximizing net economic yield (the present value of social benefit minus social costs) is suggested as an alternative to safe yield criteria for groundwater basin management. (Knapp-USGS)
W71-06126

MARGINAL COSTS OF ALTERNATIVE LEVELS OF WATER QUALITY IN THE UPPER MISSISSIPPI RIVER,
Minnesota Univ., St. Paul.
For primary bibliographic entry see Field 05G.
W71-06191

SUSQUEHANNA RIVER BASIN STUDY (SUMMARY),
W. J. Love.
Susquehanna River Basin Study Coordinating Committee Report, June 1970. 155 p, 56 fig, 27 tab.

Descriptors: *River basin commissions, *Investigations, *Water Resources Planning Act, *River basin development, *Planning, Watershed management, Multiple-purpose projects, Evaluation, Economic impact, Appraisals, Data collections, Environmental effects, Acid mine water, Water pollution control, Water requirements.
Identifiers: *Susquehanna River basin, Coordinating committee report, Long-range Framework Plan.

An illustrated summarization is given of a 6-yr study of the Susquehanna River Basin, begun in 1963 by a coordinating committee of representatives from the Department of Agriculture; Army; Commerce; Health, Education and Welfare; Housing and Urban Development; and the Interior; the Federal Power Commission; the States of New York, Maryland, and Pennsylvania. The collection and analysis of data and the formulation of a plan for achieving the stated objectives are described. The objectives were to evaluate the water resources potential of the Basin, determine water needs of the increasing population, analyze alternative solutions, recommend programs necessary to manage the water resources to meet the economic and social needs of the people, and to preserve the Basin's high natural values for present and future generations. The Susquehanna drains a 27,500 sq mi area, 6,300 in New York, 20,900 in Pennsylvania, and 300 in Maryland. The river flows through intensively developed industrial areas, farm lands, and large forests with an average discharge of 25 bgd. Flow rate varies widely, from a low of 1 bgd in September 1932 to a high of 536 bgd (830,000 cu sec) in the March 1936 flood. The health and well being of the Chesapeake Bay above the mouth of the Potomac River is dependent upon the Susquehanna, which furnishes 85% of the fresh water that enters the Bay. (Lang-USGS)
W71-06227

YORK RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN-VOLUME 1, INTRODUCTION.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.

Virginia Division of Water Resources Planning Bulletin 225, Ocotober 1970. 112 p, 21 plate, 13 tab, 21 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Virginia, Watersheds (Basins), Evaluation, Hydrologic data, Climatology, Meteorology, Hydrology, Geology, Economics, Waste water (Pollution), Recreation, Agriculture, Irrigation, Impoundments, Industries, Streams, Water resources development, Planning, Navigation, Water quality.
Identifiers: *York River basin (Virginia).

The York River basin, located in the central and eastern section of Virginia, has an estimated population of 117,000 in an area of 2,661 square miles. The basin is re-examined in light of its latest growth, to project the economy of the area to the year 2020 and to determine the quantitative and qualitative water needs of the area for the future as well as for the present. The reports of the study will be contained in six volumes. This report, Volume 1, is designed to acquaint the reader with the York River basin and to present factual data relevant to the basin. The history and the natural and economic characteristics of the major political subdivisions of the basin are outlined. Other subjects discussed are the basin's water development history, existing power supply, navigation geology, mineral resources, groundwater, municipal and industrial water supply, agriculture and recreation. Drainage area data for the major rivers in the basin and their tributaries are tabulated. (Woodard-USGS)
W71-06230

YORK RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN, VOLUME III-HYDROLOGIC ANALYSIS,
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.

Virginia Division of Water Resources Planning Bulletin, November 1970. 130 p, 56 plate, 18 tab, 16 ref.

Descriptors: *Water resources development, *Virginia, *Surface waters, *Groundwater, *Hydrologic data, Data collections, Planning, Meteorological data, Rainfall-runoff relationships, Streamflow, Flow rates, Low flow, Peak discharge, Flood forecasting, Aquifers, Aquifer characteristics, Water wells, Water quality, Chemical analysis, Hydrology, Geology.
Identifiers: *York River Basin (Virginia).

The Comprehensive York River Basin Water Resources Plan in Virginia will be contained in six volumes. This report (Vol. 3) presents data and discussions of surface-water runoff, groundwater supply, climate and meteorology. Tables and plates illustrate the mean and the extremes of precipitation, temperature and other climatological data. A brief resume of this data and the history of weather conditions are included. The program for collection of surface-water runoff data is given with an explanation of how the data may be used. Curves are developed through various analytical methods to determine the probable return period in years for specified low flow intervals; an analysis is made of flow duration to determine the percent of time a specified flow will be equaled or exceeded; and curves are developed to determine the frequency of floods on a regional basis. The lithology and hydrology of geologic aquifers are discussed and related to potential groundwater availability. Data on groundwater wells are analyzed; the quality of groundwater is summarized; and plates and tables illustrate the groundwater potential for planning pruposes. (See also W71-06230) (Woodard-USGS)
W71-06231

AN ECONOMIC ANALYSIS OF THE INTERTEMPORAL ALLOCATION OF GROUNDWATER IN THE CENTRAL OGALLALA FORMATION,
Oklahoma State Univ., Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04B.
W71-06266

THE BUREAU OF RECLAMATION'S ROLE IN AMERICA'S GROWTH,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-06308

A CRAZY IDEA ON URBAN WATER MANAGEMENT,
Pennsylvania State Univ., Unversity Park. Dept. of Civil Engineering.
Sie Ling Chiang.
Water Resources Bulletin, Vol 7, No 1, p 171-174, February 1971. 2 fig.

Descriptors: *Water resources, *Water management (Applied), *Cities, *Storm runoff, Hydrology, Flood control, Groundwater recharge.
Identifiers: *Metropolitan water resources management, *Urban water management, *Rooftop storage, Urban hydrology.

High percentage of imperviousness in the city is the source of storm runoff. Roof area contributes significantly to the imperviousness. An attempt to

make use of roofs as urban flood control device and water conservation measure is advocated. Two different schemes, one for built-up industrial-commercial area, the other for residential area, are suggested. The former utilizes the roof as detention reservoir for flood control, the latter employs recharge pit to convert runoff into groundwater resource. The proposed schemes are not only hydrologically, hydraulically and structurally sound but also economically feasible. It is worth considering in the future planning of urban renewal and urban development. (Davis-Chicago)
W71-06309

LAND USE FUNCTION IN WATER QUALITY MANAGEMENT,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Water Resources Bulletin, Vol 7, No 1, p 162-170, February 1971. 17 ref.

Descriptors: *Land use, *Water quality, *Water quality control, Water policy, Land management, Water pollution control, Standards, Regulation, Runoff.
Identifiers: *Water quality management, *Land use policy, Land use control.

The Nation has entered a new era of water quality management in which land use policy and regulation must assume an increasingly important role. The benefits of tertiary and advanced waste treatment may be offset by contradictory land use and pollution from land runoff. Unless land use planning and controls are included in water quality management, land-imposed constraints on water quality can be anticipated. Pollution from major types of land runoff are reviewed with respect to sources, effects, and control procedures. Emphasis is given to land use practices and controls. The crucial issue with regard to the latter is lack of land use policies at federal, state, and local levels. State legislation establishing guidelines and minimum standards for land use regulation by local government is required. The dependency of water quality on land use points to the fallacy of attempting to provide for comprehensive water pollution control outside the context of comprehensive land-water resources planning and management. (Davis-Chicago)
W71-06310

ECONOMIC DESIGN OF CENTRAL WATER SUPPLY SYSTEMS FOR MEDIUM SIZED TOWNS,
Illinois State Water Survey, Urbana.
Krishan P. Singh.
Water Resources Bulletin, Vol 7, No 1, p 79-92, February 1971. 4 fig, 2 tab, 7 ref.

Descriptors: *Water supply, *Cities, *Costs, Networks, Network design, Pipelines, Interbasin transfers, Urbanization, Pumping plants, Design.
Identifiers: *Water supply systems, *Economic design, Conveyance cost.

Adequate and good quality water supply for medium sized towns is costly when there are insufficient quantity and low quality of groundwater or surface water. In a central water supply system serving a number of towns, the economics of scale may permit a sufficient and good quality supply at lesser rates. Such a system has the flexibility of supplying rural population through small service lines. The system may be an interbasin or intrabasin conveyance depending on the location of a suitable water source and the economics of the supply network. Seven cost elements are pertinent to the optimum or least-cost design of network consisting of pipelines and pumping stations. The relevant cost functions are based on the available data gathered from various sources. Water conveyance costs are calculated for various flow rates, pipeline diameter, flow variabilities, static heads, and interest rate, thus providing a measure of sensitivity of the conveyance cost to such variations. The economics of scale, the sensitivity of optimum unit conveyance costs, and variations in unit costs with change in cost functions are useful in making a feasibility study for a proposed conveyance system. (Davis-Chicago)
W71-06312

MEASURING INTANGIBLE BENEFITS--SOME NEEDED RESEARCH,
Massachusetts Univ., Amherst. Dept. of Agricultural and Food Economics.
J. B. Wyckoff.
Water Resources Bulletin, Vol 7, No 1, p 11-16, February 1971. 19 ref.

Descriptors: *Methodology, *Research and development, *Intangible benefits, Cost-benefit analysis, Costs, Benefits, Aesthetics, Measurement, Analytic techniques.
Identifiers: *Water project analysis, Multiple objective functions, Tradeoff models.

Society has long sought to maximize the welfare of its members by allocating its limited resources so as to provide maximum satisfaction. As long as all of the values that society gains or loses are measured in the market place in terms of price, the process of maximizing through economic models is relatively straightforward. However, the total value that society receives from the use of its resources is not completely measured through the private market transactions. There are some values created which are external to the market system. The resulting underinvestment in natural resources by the private sector necessitates the entry of the public sector. The presence of intangible benefits and intangible costs has long been recognized, but completely satisfactory methods for including these in the quantitative analysis of benefit-cost have not been developed. Some progress has been made in including recreational values in project analysis via the expenditures method, the Gross National Product method, consumer surplus method, cost method, market value method, and monopoly and discriminating monopoly methods, but little has been done in the area of aesthetic values. Techniques for including such values in project analysis need to be further researched. Tradeoff models developed by market researchers, the advertising industry, social psychologists and sociologists may have some applicability. Moethodology for including proposed multiple objective functions in project analysis is also a critical need. (Davis-Chicago)
W71-06313

WATER RESOURCES MANAGEMENT IN THE PUBLIC INTEREST,
New York State Dept. of Environmental Conservation, Albany.
Terence P. Curran.
Water Resources Bulletin, Vol 7, No 1, p 33-39, February 1971. 18 ref.

Descriptors: *Water resources development, *Planning, *Social aspects, *Decision making, Political aspects, Social values, Ethics.
Identifiers: *Water resources management, *Public interest, Public participation, Planning objectives, Political ethics, Interest groups.

The water resources manager, concerned with providing for citizen needs in all its varied aspects, is obliged to consider the public interest in his decision making. But the public interest, although inferring the superiority of public over purely private interests, is more of a concept of political ethics than an operational objective. Recent attacks on water resources developments place in question just how responsive the water resources manager has been to the public at large during the planning process. The recent broadening of planning objectives beyond economic efficiency to include greater attention to social goals is an encouraging development. Efforts should be expanded toward greater citizen participation and more attention should be given to sampling surveys to determine citizen attitudes on water resources proposals. In the last analysis, the decision-making process must com bine the expertise of the water resources manage and the participation of the people through th political process. (Davis-Chicago)
W71-06314

PUBLIC PARTICIPATION IN WATE PLANNING: A CRITIQUE OF THEORY, DOC TRINE, AND PRACTICE,
Colorado State Univ., Fort Collins. Dept. of Polit cal Science.
Norman Wengert.
Water Resources Bulletin, Vol 7, No 1, p 26-3 February 1971. 1 fig, 14 ref.

Descriptors: *Water resources developmen *Planning, *Methodology, *Decision makin Political aspects, Political constraints, Institutions Identifiers: *Public participation.

Water development planning has virtually since i beginnings over one hundred fifty years ago utilize a variety of devices for involving segments of th public. But a new insistence for increased publi participation, particularly at the Federal level, ha stimulated re-examination of objectives an methods for relating water planning to citizen in terests and preferences. Involved is partly a recon mitment to democratic symbols, partly a recogn tion that segments of society have been ove looked, and partly a reaction to the pressures c confrontation and demonstration. The rhetoric an polemics of participation have often impled a kin of 'town-meeting' process of decision, difficult a best in a nation of 200 million. In water plannin more emphasis has been placed on listening t citizens, which has meant providing opportunitie for influentials to express their views an preferences. A more adequate approach woul seem to require identification of all who are signif cantly affected by plans and proposals (eve though they may not perceive their interest). Bu gaining greater participation does not make th planning job easier. It may increase tension an conflict; it may require difficult choices; and it ca later existing power relationships and generat changes with considerable consequences for th agency and its programs. (Davis-Chicago)
W71-06315

IMPROVING WATER RESOURCE ALLOCA TION THROUGH DEMAND-ORIENTE WATER POLICY,
Texas A and I Univ., Kingsville. Dept. c Economics.
Ronald D. Finster.
Water Resources Bulletin, Vol 7, No 1, p 17-2 February 1971. 1 tab, 4 ref.

Descriptors: *Water allocation (Policy), *Wate policy, *Water supply, *Water demand Economics, Regions, Regional analysis, Arizona Resource allocation, Inter-basin transfers, Ari lands.
Identifiers: *Demand-oriented water policy.

In the arid and semi-arid regions of the Wester United States the water problem is generally pe ceived as one of 'inadequate' supply. This concep tion of the problem engenders supply-oriente water policy, or policy focusing exclusively upon single class of solutions - the various schemes fo augmenting an area's water supply. In a mor complete or balanced conceptualization, the wate problem is viewed as one of 'inadequate' suppl and/or 'excessive' demand. When the wate problem is so conceived, water policy is broadene to include demand-oriented water policy, or polic aimed at reducing the quantity of water demande in an area. The purpose of this paper is to describ and explain demand-oriented water policy. Bas cally it consists of changing the set of commoditie produced by the economy, cutting back and/o eliminating goods requiring large quantities c water in their production and introducing and/o expanding goods which require little water. Thi paper also reports briefly on research undertake

est demand-oriented policy in Arizona. Results icate that such a policy can be extremely effica- us in solving a region's water problem. (Davis- icago)
1-06316

OLOGY AND SPATIAL ANALYSIS,
chigan Univ., Ann Arbor. Dept. of Geography.
primary bibliographic entry see Field 06F.
1-06317

ONOMIC ASPECTS,
a State Univ., Ames. Dept. of Economics.
primary bibliographic entry see Field 05G.
1-06447

. Cost Allocation, Cost Sharing, Pricing/Repayment

CRITICAL SURVEY OF USE OF COST-EFIT ANALYSIS IN PUBLIC FINANCE,
n Univ. (Italy).
no Contini.
Quantitative Analysis in Public Finance New k, Praeger Publishers, p 65-89, 1969.

criptors: *Cost-benefit analysis, *Irrigation, onomic efficiency, *Flood control, *Model stu- *Forecasting, *Water treatment, Investment, ulation, Weather, Marginal costs, Technology, es, Costs, Recreation.
tifiers: Partial equilibrium analysis, Income stribution, Externalities, Consumer surplus, ortunity costs, Health programs.

article discusses the basic uses of cost-benefit ysis in public finance. An analogy of a horse rabbit stew is used to juxtapose the con- ences that can be measured and evaluated nu- cally with an amalgam of external effects, so- emotional and psychological impacts, and rical and aesthetic considerations. It is as- ed that the use of cost-benefit analysis is ed to use as a tool of partial equilibrium analy- ince the technique of such decision-making be utilized within a framework that has been led upon in advance. The need for cost-benefit ysis to handle both allocation and redistribu- effects is considered in detail. Valuation of fits is discussed using many examples in the r and natural resource areas. Timing difficul- re also analyzed, using certain applications in ontext of water resource development. Costs hen similarly analyzed. Intangible effects of benefit analysis are also discussed with par- ar attention to problems of recreation, flood ol systems, education, and health programs. article provides a background discussion for benefit decision-making in the water resource (See also W71-05947) (Murphy-Rutgers)
05948

FISCAL ECONOMIST AND QUANTITA- ANALYSIS,
Univ. (England).
T. Peacock.
uantitative Analysis in Public Finance, New Praeger Publishers, p 3-11, 1969.

iptors: *Cost-benefit analysis, *Economic ef- cy, *Government, Decision-making, ource development, Budgets, Optimization, l aspects, Statistics, Environment.
fiers: *Econometric techniques, Productivity sis, Quantitative analysis, *Preferences, ource growth, Inflation, Public goods.

rticle briefly summarizes several studies on itative analysis and relates their content to rious stages of the process of formulating and ting policies through the system of public e. The use of cost benefit analysis as a means ject appraisal in the resource area is studied t of the ultimate goal of efficiency. Particular attention is given to several aspects of this problem. Articulation of preferences is discussed as being typical of the recent development of nonmarket economics which utilizes economic concepts in analyzing community choices and their effects on public policy. Various hypotheses about government sector growth are presented as they relate to these consumer preferences. Extensive treatment of cost-benefit and efficiency analysis is presented, both from the viewpoint of mathematical constructs and statistics and from the viewpoint of correct specification of the economics underlying such appraisals. This article is relevant to water studies in presenting the recent extension of economic analysis to non-market phenomena in the public finance area. (Murphy-Rutgers)
W71-05956

COLLECTIVE ACTION AND THE DISTRIBUTION OF INCOME: A CONCEPTUAL APPROACH,
Wisconsin Univ., Madison.
Burton A. Weisbrod.
In: Public Expenditures and Policy Analysis Chicago, Markham Publishing Company, p 117-141, 1970.

Descriptors: *Income, *Government, *Cost-benefit analysis, *Economic efficiency, Taxes, Flood control, Economic evaluation, Government supports, Welfare economics.
Identifiers: *Resource allocation, *Economic stabilization, *Allocative efficiency, Income transfers, Criteria, Public policy, Poverty.

The income redistribution function of the federal government is considered as interrelated with the other government functions of allocative efficiency and economic stabilization. Topics treated include the ways by which government activities affect the distribution of income in the society, types of redistributional programs, criteria for judging such programs, and conflicts among the various criteria. Direct redistributive activities such as welfare payments are compared with indirect activities which also serve to redistribute income, such as tax policies. The direct and indirect consequences of economic stabilization policies and resource allocation policies on the distribution of income are also considered at some length, using the examples of education and flood-control policy. Six criteria by which such widespread effects of government on income distribution are then surveyed and various advantages and disadvantages of each are presented. The article is particularly useful in the cost-benefit analysis of income distribution effects resulting from water resource investments. (Murphy-Rutgers)
W71-05960

THE ORGANIZATION OF ECONOMIC ACTIVITY: ISSUES PERTINENT TO THE CHOICE OF MARKET VERSUS NONMARKET ALLOCATION,
Harvard Univ., Cambridge, Mass.
Kenneth J. Arrow.
In: Public Expenditures and Policy Analysis, Chicago, Markham Publishing Company, p 59-73, 1970.

Descriptors: *Natural resource allocation, *Cost benefit analysis, *Costs, Economic evaluation, Taxes, Government, Economic efficiency, Optimization, Risks.
Identifiers: *Externalities, *Competitive equilibrium, *Transaction costs, *Market failure, Collective action.

Various issues relevant to both market and nonmarket means of resource allocation are surveyed. The lack of precision in general market situations is cited, calling for exact relationships between such pertinent concepts as public goods, externalities, appropriability and exclusion. It is pointed out that the absence of conditions which assure a Pareto efficient competitive equilibrium situation usually results in resorting to nonmarket channels of resource allocation, such as government expenditures, taxes and subsidies. Externalities are also analyzed in terms of criteria, namely, benefit cost and second best analyses. The import of transaction costs on market failure is also discussed in some detail, particularly in relationship to monetary theory and in the identification of such costs in different contexts and under different systems of resource allocation. It is proposed that a wide variety of social institutions exist which serve as compensation for the failure or limitation of the market, although each of these involve transaction costs of their own. Economic analysis of these different contexts of choice is prerequisite to contemporary resource allocation. (Murphy-Rutgers)
W71-05966

A NOTE ON BIASES IN CAPITAL BUDGETING INTRODUCED BY INFLATION,
Stanford Univ., Calif.
James C. Van Horne.
Journal of Financial and Quantitative Analysis, Volume VI, Number 1, p 653-658, January 1971.

Descriptors: *Capital costs, *Budgeting, *Investment, Economic analysis, Decision-making, Risk, Financing, Prices, Debt, Prices.
Identifiers: *Inflation, *Capital allocation, Cost of capital rates, Acceptance criterion, Cash flows, Taxes, Price index.

The importance is considered of anticipating inflation in cash-flow estimates tend to eliminate the bias which arises due to the cost-of-capital rate generally used as the acceptance criterion. This article investigates the nature and origin of this bias. A hypothetical investment situation is proposed, which uses the cost-of-capital rate for project selection. In this situation, it is assumed that there is no capital rationing, that acceptance of the investment project will not alter risk complexion, and that the capital structure consists entirely of equity. A discussion of inflation is then presented and the need for incorporating an element of anticipated inflation is proven. It is also indicated that the correspondence of this element to the rate of anticipated inflation, as indicated by price index changes, depends upon the preference functions of investors relative to the price index employed. This article is valuable for use in reference to water resource investment projects, since it illustrates the importance of accounting for anticipated inflation in long-term decision-making. (Murphy-Rutgers)
W71-05969

6D. Water Demand

PROVIDING REASONABLE WATER SERVICE,
American Water Works Association, New York.
Abel Wolman.
In: Water, Health and Society, Bloomington, Indiana University Press, p 133-142, 1969.

Descriptors: *Water supply, *Water utilities, Economic analysis, *Water demand, Natural resources, Industrial water, Capital cost, Investment, Cost-benefit analysis, Water treatment, Reservoirs, Taxes, Financing, Population, Conservation.
Identifiers: *U.S. Geological Survey, *Water service, Inflation, Depression, Consumers.

This article presents common water consumer complaints and suggests reasonable water service to counteract these difficulties. The author begins by surveying water difficulties in the United States and several selected foreign countries such as Great Britain, Manila, and Japan. Among the causes of inadequate water service are scarcity of materials and manpower, inflation, increased per capita water use, rapid industrial expansion, population growth, metropolitan growth, public inertia, restrictions on increases in water rates, and prevailing waterworks opinion over the last half century. The nature of reasonable water service is proposed as consistent and continuously available water ser-

vice for all sensible water use demands. Several steps are proposed as preparation for achieving this reasonable water service, such as maintenance of continuing technical review, development of criteria of adequacy, development of public relations programs, reconciliation of costs and income, provision of machinery for metropolitan areas, and reexamination of improvement financing. The major problem cited is the economic aspect of water improvement programs and the cost and revenue problem is dealt with in some detail. (Murphy-Rutgers)
W71-05942

THE DEMAND FOR LEISURE,
New School for Social Research, New York.
John D. Owen.
Journal of Political Economy, Vol 79, No 1, p 58-76, January/February 1971.

Descriptors: *Recreation demand, Regression analysis, Price elasticity, Least squares method.
Identifiers: *Complementarity, *Demand for leisure, Income elasticity, Full income, Autocorrelation, Measurement error.

The relationship is considered between the demand for leisure time and the demand for market recreation, a closely related good. Complementarily between leisure time and market recreation is estimated empirically be regressing the demand for leisure time of U.S. employees from 1900-1961 on the relative price of recreational goods and services, holding real income and the relative price of leisure constant. The regression estimates support the hypothesis that leisure time and market recreation are complements with 25 percent of the estimated long term increase in demand for leisure explained by a decline in market recreation prices. Improvements in the estimation of the demand for leisure time were obtained when the price of recreation was used as a regressor and when the effects of changes in the unemployment rate on the demand for leisure is considered. This paper is relevant to water studies concerned with the demand for water-based recreational facilities. (Siegenthaler-Rutgers)
W71-05970

PUBLIC WATER FOR RURAL AREAS AND SMALL TOWNS,
Missouri Univ., Columbia. Dept. of Agricultural Economics.
Coy G. McNabb, and Melvin G. Blase.
Missouri University Cooperative Extension Division Report MP105, 1969. 12 p, 2 tab. OWRR Project No A-018-MO (2).

Descriptors: *Public utilities, *Water supply, *Missouri, *Rural areas, Water distribution (Applied), Water management (Applied), Water policy, Water utilization, Distribution systems.
Identifiers: Rural water systems.

The number of rural water supply systems in Missouri has increased since 1965, the year the Farmers Home Administration expanded its loan program for this purpose. FHA offers financial assistance to two general types of water distribution organizations, (1) municipal systems which include villages, towns, or cities with less than 5,500 population, and (2) rural districts. Problems and characteristics of districts which were in operation at the time of study are described. (Knapp-USGS)
W71-05973

COOLING WATER RESOURCES AND POWER GENERATION,
Southern California Edison Co., Los Angeles.
For primary bibliographic entry see Field 05G.
W71-06091

IMPROVING WATER RESOURCE ALLOCATION THROUGH DEMAND-ORIENTED WATER POLICY,
Texas A and I Univ., Kingsville. Dept. of Economics.
For primary bibliographic entry see Field 06B.
W71-06316

WATER REQUIREMENTS FOR MANUFACTURING,
Business and Defense Service Administration, Washington, D.C. Water Resources and Engineering Service Div.
K. L. Kollar, and R. Brewer.
Journal American Water Works Association, Vol 60, No 10, p 1129-1140, October 1968. 9 tab, 7 ref.

Descriptors: *Water requirements, *Census, Withdrawal, Treatment, Brackish water, Rates, Water reuse, Sea water, *Water utilization, *Industrial plants, *Industrial water.
Identifiers: *Source of water, *Recirculation, Economic projections, Large water-using manufacturers.

This is a statistical presentation of national developments in recent years in the industrial water usage field. Further, it lays down some basic guidelines which must be reasonably followed if the nation is to continue to develop and prosper with the relatively fixed amount of total water available. Some properties of large water-using manufacturers were discussed. The data indicate the source of the increased demands will be company-controlled surface fresh water sources and brackish supplies rather than wells or public water system. Treatment and uses of water in manufacturers were discussed. It was estimated that the overall recirculation rate was 1.10 and it was noted that higher recirculation rates were found in regions where water is least abundant. The relation between water consumption and manufacturing production was discussed. Tabulated data presents the projected series of important economic parameters and the quantities of manufacturing water associated with them. This paper pointed out an important trend of reuse of waste water and recirculation in manufacturing. (Wang-Rutgers)
W71-06318

WATER USE BY APPALACHIAN MANUFACTURERS,
Business and Defense Service Administration, Washington, D.C. Water Resources and Engineering Div.
K. L. Kollar, and R. Brewer.
Water use by Appalachian Manufacturers-1964, p 1-28, December 1967. 37 tab, 9 charts.

Descriptors: *Water use, *Appalachia, Profiles, Productivity, Census, Water costs, Value added, Water utilization, Industrial plants, Industrial water.
Identifiers: *SIC, Non-Appalachia, Recirculation ratio.

This is a report concerning the use of water by industries in Appalachia and the relationship of that use to other economic factors. The availability of water in Appalachia, manufacturing and U.S. economy, water use in U.S. manufacturing, manufacturing in Appalachia, and water use by Appalachian manufacturers were discussed. The scope of work involved the use of data from the 1964 Census of Manufacturers from those manufacturing establishments which use more than 20 million gallons of water annually. Special extractions of data were made to permit comparisons of establishments within Appalachia with those in non-Appalachia conterminous United States. Other economic data for the same year and geographic areas, such as employment, value added, value of shipments, water conservation by reuse and recirculation were presented. Profiles of selected industries included poultry and small game, paper mills, paperboard mills, alkalies and chlorine, plastic materials, blast furnace, iron steel, and drugs were presented, water use in th industries were discussed. The large quantities good quality water that are available can be utili to further the industrial and economic devel ment in Appalachia. (Wang-Rutgers)
W71-06319

6E. Water Law and Institutions

MCGEHEE V WILLIAMS (CONTRA BETWEEN CITIES FOR PROVISION WATER).

87 SW2d 46-49 (Ark 1935).

Descriptors: *Arkansas, *Municipal water, *W supply, *Contracts, Local governments, W requirements, Reservoir construction, Reserv Reservoir operation, Reservoir storage, Water Marketing, Utilities, Water works, Legal aspe Cities, Judicial decisions.

Plaintiff taxpayers sought to enjoin the further formance of a contract between defendant ci Alma and Fort Smith. Alma had contracted to water from Fort Smith, which was building a waterworks system. Plaintiff taxpayers conten that the contract was illegal, ultra vires, and v Defendant cities demurred to the complaint, the trial court sustained the demurrer. Supreme Court of Arkansas held that the tow Alma had the power and authority to purch water from any source and to contract to that fect. Fort Smith had the power to sell its surp water to persons outside the city and to contrac that effect. The contract was not in violation of Arkansas constitution. (Robinson-Florida)
W71-05836

DRAINAGE DIST NO 7 V HAVERSTICK (L BILITY FOR DIVERSION OF NATUR WATERCOURSE).
53 SW2d 589-593 (Ark 1933).

Descriptors: *Arkansas, *Drainage districts, teration of flow, *Diversion, Damages, Floodw Reservoirs, Dams, Levees, Flood control, R flow, Natural flow, Natural flow doctrine, Wa courses (Legal), Riparian rights, Local gove ments, State governments, Judicial decisions, Le aspects, Flood routing, Floods, Flooding.
Identifiers: Statute of limitations.

Plaintiff landowner sued defendant drainage trict for damages. Defendant had dammed a ri diverted its waters into an artificial floodway, discharged the water into the river furt downstream and opposite plaintiff's land, ther submerging plaintiff's land. Defendant conten that the right to drain into a natural watercours not limited to the natural capacity of the stre Defendant also contended that plaintiff had fa to bring suit within the statutory period. In affi ing a trial court decision for plaintiff, the Supre Court of Arkansas pointed out that the right drain into a natural river was not involved, rather the right to divert the natural flow of a ri A diversion of a river from its natural course, the subsequent acceleration in its flow, is a pro ground for a damage suit. As plaintiff had brou suit while a dam and a reservoir were still in c struction, they being an essential part of drainage district improvement, the action brought within one year after construction of drainage system. (Smiljanich-Florida)
W71-05876

UNITED STATES V BIG HORN LAND A CATTLE CO (FORFEITURE OF RIGHT-O WAY ON PUBLIC LAND).

17 F2d 357-366 (8th Cir 1927).

Descriptors: *United States, *Right-of-way, *Easements, *Dams, Diversion, Lakes, Legal aspects, Judicial decisions, Federal government, Diversion structures, Diversion dams, Structures, Ditches, Irrigation ditches, Irrigation, Governments, Water levels, Elevation, Height.

Defendant obtained from plaintiff United States a right-of-way entitling defendant to construct and maintain a ditch and to dam a public lake for purposes of irrigation. Plaintiff sought a decree of forfeiture, contending that defendant had not within the required period constructed facilities capable of raising the water level of the lake to the height specified in defendant's application for the right-of-way. Defendant contended that, although it had not raised the water level the specified 16 feet, it had constructed a ditch system and a small dam, all of which should be considered in evaluating the extent of defendant's performance. The Eighth Circuit Court of Appeals reversed a judgment for defendant. The Act of 1891, under which rights-of-way in public lands were granted for purposes of irrigation, provided for forfeiture of any section of a right-of-way where substantial construction had not occurred within 5 years of the grant. The proposed reservoir was a section separate from the ditch in the instant case. Sufficient reservoir construction was not accomplished. Defendant's exclusive right-of-way continued only as to the ditch and diversion facilities. (Dye-Florida)
W71-05911

5 YEARS OF IMPROVEMENT IN WATER UPPLY QUALITY,
merican Water Works Association, New York.
bel Wolman.
: Water, Health and Society, Bloomington, Indiana University Press, p 93-103, 1969.

escriptors: *Water supply, *Water quality, Water treatment, Filtration, Chlorination, Coagulation, Watersheds, Sewerage algae, Potable water.
entifiers: *American Water Works Association, hemical industry, Odor, Taste, Consumer.

his article discusses the various efforts of the merical Water Works Association, in both chnological and scientific fields, to provide water maximum usefulness and satisfaction to the conmer over the last 75 years. Advances in water pply such as effective coagulation, sedimentaon, filtration, disinfection and the use of chlorinaon are surveyed as milestones in water supply ality. Specific water quality analysis difficulties e assessed from the points of view of both the ater diagnostician and the consumer. Particular tention is given to the identification of sources d causes of taste and odor, and the relationship these to algae and to the burgeoning chemical instry. The use of such remedies as powdered acated carbon, ozone, chlorination, and chlorine oxide is discussed. Advances in the water supply ality are attributed to the development of standrd methods of analysis and to the judicious use of mmercial equipment. A rapid trend is hypothesed toward the literal tailoring of water for the mestic, industrial, or farming consumer as quirements of water supply quality become more merous and complex. (Murphy-Rutgers)
71-05943

IE 'PROBLEM SHED' AS A UNIT FOR ENRONMENTAL CONTROL,
sources for the Future, Inc., Washington, D.C.
r primary bibliographic entry see Field 06B.
71-05945

ONE V MAY (RIPARIAN RIGHT TO ACCREONS WHERE FORMER RIPARIANS' LAND AS ERODED).

5 NW 367-369 (Iowa 1929).

scriptors: *Iowa, *Accretion (Legal aspects), iparian land, *Boundaries (Property), Avulsion, Riparian rights, Riparian waters, Boundary disputes, Navigable rivers, Missouri River, Navigable waters, Bank erosion, Erosion, Channel erosion, Land tenure, Real property, Prescriptive rights, Legal aspects, Judicial decisions.

Plaintiff landowner sued defendant landowners to quiet title to the land between plaintiff's land and the east bank of the Missouri River. Plaintiff contended that at one time, the east bank had gradually eroded all the disputed land, leaving plaintiff as the riparian owner and entitling him to all the land since formed by accretion. Defendants asserted various decrees and sources of title, including adverse possession, and contended that portions of the river bed had changed by avulsion rather than by accretion. Affirming a judgment for plaintiff, the Supreme Court of Iowa noted that in the face of conflicting evidence, the presumption is in favor of accretion as against avulsion. The court held that plaintiff's one time riparian status entitled him to all later accretions even where such accretions covered property of former riparian owners. (Liptak-Florida)
W71-05952

ASD SECURITIES V J H BELLOWS CO (RIGHT-OF-WAY OF NECESSITY WHEN ACCESS BY WATER BECOMES IMPOSSIBLE).
48 Ohio App 101, 192 NE 472-473 (1933).

Descriptors: *Ohio, *Easements, *Right-of-way, *Navigable waters, Land, Land tenure, Judicial decisions, Legal aspects, Navigation, Real property, Ponds.

Plaintiff sought to enjoin defendants from interfering with a right-of-way of necessity which plaintiff claimed across defendants' land. Plaintiff had succeeded to a right-of-way across a pond to lands which plaintiff's predecessor had purchased from defendants. The pond dried up occasionally and became at such times impossible to cross. Because of this, plaintiff claimed a right-of-way of necessity across defendants' land. The Court of Appeals of Ohio ruled for plaintiff. There are many holdings that a way of necessity will not be held to exist where there is already access to property over a navigable body of water. However, such a rule is inapplicable where water becomes too shallow for navigation and becomes impassable due to sogginess. (Duss-Florida)
W71-05958

O'HEARN V TOWN OF ADAMS (DAMAGES FOR OVERFLOW OF SEWAGE).
288 Mass 185, 192 NE 524-527 (1934).

Descriptors: *Massachusetts, *Damages, *Overflow, *Sewage, Sewers, Streams, Channels, Land, Land tenure, Diversion, Maintenance, Cities, Legislation, Rivers, Eminent domain, Legal aspects, Judicial decisions.

Plaintiff landowners brought a tort action against defendant town for damages to land and property resulting from the overflow of a river and discharge of sewage from an alleged common sewer. Plaintiffs alleged that the damage complained of resulted from acts of the superintendent of sewers commencing sixteen years before filing of action. The superintendent had diverted stream water into a channel near plaintiffs' land and extended the sewer line to this channel. The Supreme Judicial Court of Massachusetts gave judgment for defendant. Private actions will lie against a municipality where it is negligent in maintaining a common sewer, control of which is authorized by statute. However plaintiff must show that the town was obligated to do the work resulting in injury or that it was an exercise of corporate power. Here the proximate cause of injury was not the building and maintenance of the sewer but diversion of the stream. Further, plaintiff must show acceptance by the town of the statute relating to laying out of sewers. In the instant case defendant had not accepted the statute. Liability could not be predicated on eminent domain as there was no taking of plaintiffs' land. (Duss-Florida)
W71-05967

INSTITUTIONAL FACTORS INFLUENCING WATER DEVELOPMENT IN TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06B.
W71-05972

PUBLIC WATER FOR RURAL AREAS AND SMALL TOWNS,
Missouri Univ., Columbia. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06D.
W71-05973

GIVENS V CHANDLER (INJUNCTION TO PROHIBIT INTERFERENCE WITH WATER SUPPLY).

143 So 79-81 (La App 1932).

Descriptors: *Louisiana, *Wells, *Pipelines, *Water rights, Water sources, Artesian wells, Judicial decisions, Legal aspects, Pipes, Water conveyance, Water sources, Relative rights, Real property, Damages, Water supply, Water utilization, Easements, Natural use, Adjudication procedure, Reservation doctrine, Water contracts.

Plaintiffs sought damages and an injunction to prohibit defendant from interfering with plaintiffs' right to lay a pipe for the withdrawal of water from a well on defendant's property. Plaintiffs sold to defendant a lot adjacent to their own with a reservation in the deed retaining an undivided one-half interest in an artesian well thereon and the right to secure water therefrom. Plaintiffs laid a pipe from their lot to draw water from the well. Defendants acquiesced in such action and urged no objection to the pipe's use for over a year. Subsequently, defendant tore out the pipe and refused to allow plaintiff to reconnect it to the well. Plaintiff brought suit, and defendant alleged that the character of the servitude was not such as to allow the utilization of a pipe to withdraw the water from the well. The trial court held for plaintiffs, granting the injunction prohibiting defendant from interfering with plaintiffs' replacing the necessary pipe, but denying plaintiffs damages. The Court of Appeals of Louisiana affirmed issuance of the injunction and awarded plaintiffs damages. Where a defendant willfully breaches a contract such as the one in this case all damages arising from the breach are recoverable. (Barnett-Florida)
W71-05976

APPALACHIAN ELECTRIC POWER CO V SMITH (CONSTITUTIONALITY OF HYDROELECTRIC PROJECT LICENSING).
67 F2d 451-458 (4th Cir 1933).

Descriptors: *Dams, *Navigable rivers, *Nonnavigable waters, *Federal Power Act, Hydroelectric plants, Hydroelectric project licensing, Administrative agencies, Federal project policy, United States, Land tenure, Riparian land, Real property, Adjudication procedure, Judicial decisions, Legal aspects, Administrative decisions, Permits, Federal government.
Identifiers: *Constitutionality.

Plaintiff electric company sued defendant members of the Federal Power Commission individually to remove a cloud on title to riparian land. Plaintiff contemplated erecting a dam on a non-navigable tributary of a navigable river and filed a declaration of intent with defendant as a prerequisite for obtaining a permit. Defendant issued plaintiff a standard form license, which plaintiff refused; plaintiff then requested defendant to either disclaim jurisdiction over the project or issue a minor form license under provisions of the Federal Water

Power Act, which would only contain conditions prohibiting interference with the navigability of the main river. Defendant refused, whereupon plaintiff filed suit, alleging that defendant's acts were unauthorized and unconstitutional. Defendant moved to dismiss for lack of jurisdiction. The lower court denied defendant's motion, but dismissed the complaint on the merits. Since defendants as individuals had threatened no action to prevent dam construction, the United States Court of Appeals reversed, holding that the federal courts had no jurisdiction to enjoin defendant's actions. Furthermore, since the United States was not joined, the court held that it was without jurisdiction to set aside the alleged title cloud. (Hart-Florida)
W71-05977

UNION SAND AND GRAVEL CO V NORTHCOTT (TITLE TO LAND BETWEEN HIGH AND LOW WATER MARKS).

135 SE 589-593 (Sup Ct App W Va 1926).

Descriptors: *West Virginia, *Low water mark, *Ownership of beds, *Boundary disputes, Boundaries (Property), River beds, Bands, Navigable rivers, Rivers, Navigable waters, Land, Real property, Legal aspects, Judicial decisions, Public rights, Riparian rights, Riparian land, Navigation, High water mark, Legislation, Beds under water, Streambeds, Gravels, Sands, Islands.

Plaintiff sought to recover the value of sand and gravel removed by defendant gravel company from island property above the low water mark. Plaintiff claimed title to the low water mark. Defendant contended that: (1) plaintiff's title was only to the high water mark; (2) if to the low water mark, plaintiff's title was only to the ordinary low water mark; and (3) plaintiff's title, if to the low water mark, should be to that level as modified by existing locks and dams. The Supreme Court of Appeals of West Virginia affirmed judgment for plaintiff. The owner of land bounded by a navigable river holds title to the low water mark, subject only to the public right of navigation. In determining boundaries, the low water mark is the farthest ebb of the tide, not the ordinary low water mark. The low water mark is to be determined with respect to the river in its natural condition and is not altered for legal purposes by public construction of dams or locks. (Dye-Florida)
W71-05979

HOME REAL ESTATE LOAN AND INS CO V PARMELE (STATE MAY PASS TITLE TO NON-NAVIGABLE TIDAL WATERS).
214 NC 63, 197 SE 714-719 (1938).

Descriptors: *North Carolina, *Tidal waters, *Coastal marshes, *Reservation doctrine, Land reclamation, Legal aspects, Judicial decisions, Remedies, Federal government, State governments, Navigable waters, High water mark, Low water mark, Ownership of beds, Swamps, Dredging, Channel improvement, Tides, Tidal effects, Land tenure.
Identifiers: *Intracoastal waterway.

Plaintiff corporation asked for a court determination of whether it could transfer to defendant title to 2,000 acres of tidal marshland that plaintiff had purchased from the state board of education. Defendant had signed a purchase contract but refused to accept delivery, asserting that reclamation of some of the land had revested title in the state. The Supreme Court of North Carolina affirmed a decision for plaintiff. The state has title to all beds under navigable water and may not convey the land for such purposes which would impede navigation. However, the American rule is that navigable waters are those that are in fact navigable, not merely tidal. The state thus could sell such lands constitutionally, and a statute allowed sale to plaintiff's predecessor in title. Plaintiff had fee simple title. Were the lands navigable, the state could merely have granted an easement for limited purposes to underwater land. When the title granted was fee simple, however, reclamation did not revest title in the state. (Hart-Florida)
W71-05980

EDWARDS V ATCHISON, T AND S F RR (PRESCRIPTIVE RIGHT TO DISCHARGE WATER).

15 F2d 37-38 (9th Cir 1926).

Descriptors: *California, *Discharge (Water), *Culverts, *Prescriptive rights, Surface waters, Railroads, Legal aspects, Judicial decisions, Precipitation excess, Conduits, Land, Damages, Surface drainage, Rain, Rainfall, Erosion, Real property, Rain water, Surface runoff, Riddance (Legal aspects).

Defendant railroad held a right-of-way adjacent to plaintiff's land. The right-of-way was elevated and allowed the passage of water through it only at the location of a culvert discharging onto plaintiff's property. Heavy rains resulted in damage to plaintiff's land when water was discharged in large quantities from the culvert. Plaintiff sought damages. Defendant contended that a prescriptive right to discharge water onto plaintiff's land has been established. After judgment for defendant, plaintiff appealed, contending only that no prescriptive right had arisen since no prescriptive period begins to run until the servient tenement has been injured. The Court of Appeals for the Ninth Circuit affirmed the judgment for defendant. Evidence showed that water had been discharged onto plaintiff's property for a sufficient period. Each such discharge resulted in a cause of action, regardless of injury. The prescriptive right began to run after the first discharge. Further, the holder of a railroad right-of-way must have notice of the discharge of water and have been requested to remedy it before an action may be brought for injury. Interruption of use by dry seasons did not interrupt the continuity of the adverse use. (Dye-Florida)
W71-05994

KELLY V CITY OF CAPE GIRARDEAU (LIABILITY OF CITY FOR FAILURE TO PROVIDE ADEQUATE STORM SEWERS).
72 SW2d 880-884 (Ct App Mo 1934).

Descriptors: *Missouri, *Storm drains, *Damages, *Remedies, Cities, Floodwater, Drainage systems, Sewers, Overflow, Surface runoff, Flood damage, Surface drainage, Real property, Land tenure, Local governments, Flood protection, Legal aspects, Judicial decisions.
Identifiers: Injunction (Mandatory).

Plaintiff landowner sought compensatory and punitive damages for flooding of his land resulting from defendant city's inadequate storm sewers. Defendant, over a period of several years, had failed to comply with an injunction requiring it to replace the inadequate sewers. Plaintiff contended he was entitled to compensation for each incident of flooding not previously the subject of judgment. Defendant contended plaintiff's recovery of damages in a prior suit barred all claims arising prior to that action. The court held that when flooding results from an abatable nuisance, the wrong is re-created on each occasion of flooding. The injured property owner has the right to bring an action on each incident of flooding, notwithstanding prior judgment on other such incidents. Noting that the defendant's failure to comply with the prior injunction entitled the plaintiff to punitive as well as compensatory damages, the court affirmed the lower court's award of damages. (Earl-Florida)
W71-05997

TOLCHESTER BEACH IMPROVEMENT CO OF KENT COUNTY V BOYD (ABILITY OF PUBLIC TO ACQUIRE PRESCRIPTIVE ACCESS TO WATER).

156 A 795-798 (Md App 1931).

Descriptors: *Maryland, *Contracts, *Prescrip
rights, *Riparian land, Claims (Contracts), Rip
an rights, Legal aspects, Judicial decisions, E
ments, Land, Land tenure, Roads, Public rights.

Plaintiff riparian landowner brought action
specific performance of a contract for sale
riparian land to defendant yacht club. Defend
refused to consummate the sale because: (1) a s
road encroached upon the property, so that it
insufficient for appellee's needs; and (2) co
commissioners had protested appellee's permi
erect docks because local fishermen had used
area for launching boats. After observing that
public could not by long-continued use h
acquired a prescriptive right-of-way across
land, the Court of Appeals of Maryland gran
plaintiff's prayer for specific relief. The road
acquired by condemnation and the co
acquired an easement only. The riparian right
the owner were unimpaired. (Hart-Florida)
W71-05998

STATE V MOUNTS (BOUNDARIES ON N NAVIGABLE STREAMS WHERE SURVEY D FERS FROM NATURAL MONUMENTS).
150 SE 513-515 (Sup Ct W Va 1929).

Descriptors: *West Virginia, *Boundaries (Pro
ty), *Non-navigable waters, *Boundary dispu
Real property, Land, Streams, Legal aspects, J
cial decisions, Shores, Banks, Adjudica
procedure, Surveys, Meanders, Mapping, L
tenure, Taxes, Governments, State governments

Defendant received land, bounded by a n
navigable stream, in the partitioning of prop
among heirs. The partitioning court had used co
ses and distances to describe the tract. Howe
the courses and distances arrived at did not c
cide with the meanders of the stream. Plaintiff s
claimed title by forfeiture to the strip of land l
between the tract's boundary as partitioned and
water, contending that no taxes had been paid
the strip since the partitioning. The Supreme Co
of Appeals of West Virginia reversed a judgm
for plaintiff. Title to land bounded by a non-nav
ble stream extends to the thread of the stream.
entire original lot was bounded by the stream,
it was the duty of the partitioning court to incl
all of the original property in the new lots. It m
be assumed that the court did so. Those new lot
which the boundary did not coincide with
stream should have been presumed to ext
thereto. Natural monuments prevail over a
veyor's calls. (Dye-Florida)
W71-06007

THE CONSERVANCY DISTRICT LAW (OU LINE AND TEXT OF OHIO CONSERVAN DISTRICT LAW).
Ohio Dept. of Natural Resources, Columbus. D
of Water.

N.D. 65 P, 9 PHOTO, 1 CHART.

Descriptors: *Ohio, *Administrative agenc
*Drainage districts, *Water resources devel
ment, State governments, Water conservati
Water resources, Water policy, Water managem
(Applied), Water supply, Area redevelopm
Multiple-purpose projects, River basin devel
ment, Local governments, Water law, Legislati
Eminent domain, Condemnation, Rivers, Strea
Lakes, Floods, Flood control.

Although originally flood control agencies,
Ohio conservancy districts are now empowered
conserve and develop water supply, impr
drainage, collect and dispose of wastes, provide
irrigation, and arrest erosion of the Lake E
shore. This booklet discusses the organization
conservancy district, the steps in development
district, questions and answers concerning
servancy districts, and the text of the Ohio
servancy district law. The law itself is set forth
eight parts: (1) definitions, (2) organization
district; (3) powers, duties, and organization

rvancy district boards of directors; (4) ap- l of benefits; (5) financial administration; (6) orporate relations and conflict in jurisdiction; olice powers and regulations; and (8) con- ion and interpretation of the law. In addition eviously mentioned powers, the district may: ter the course of rivers and streams; (2) fill bandoned or altered watercourse; (3) con- and operate dams; (4) plant forests on dis- and; and (5) acquire by purchase or power of nt domain easements or lands to effect the ses of the act. (Hart-Florida)
06046

ER POLLUTION: OBSERVATIONS ON NECTICUT'S RESPONSE,
rimary bibliographic entry see Field 05G.
06047

ENVIRONMENTAL LAWSUIT: TRADI- AL DOCTRINES AND EVOLVING THEO- TO CONTROL POLLUTION,
imary bibliographic entry see Field 05G.
06048

GATION AND NAVIGABLE WATERS,
al Register, Vol 35, No 103, p 8279-8280, 970. 2 p.

iptors: *Administrative agencies, *Federal nment, *Navigation, *Regulation, Boating tions, River regulation, Governments, Legal ts, Transportation, Harbors, Bridges.
fiers: *Harbor lines, *Anchorages.

dments to Department of Transportation tions provide that the Secretary of Transpor- has delegated authority to the Commandant Coast Guard to issue regulations regarding nctions, powers, and duties of the Coast l. The Commandant redelegates these duties Chief of the Coast Guard Office of Opera- with a proviso that regulations pertaining to: stablishment of anchorages, (2) changes in rage regulations, and (3) affirmance of ac- of District Commanders concerning security shall not be redelegated. Furthermore, draw- operation regulations for the Sabine River, xas, are promulgated along with the revoca- f operating regulations for a removed bridge aluma, California. In addition, the adminis- procedure for the establishment of harbor s published herein by the Department of the Corps of Engineers. (Hart-Florida)
06049

ERS AND CLAMS (STATUTES GOVERN- AKING OF OYSTERS AND CLAMS).

ode Ann art 66c, secs 700 thru 701, 707, 713 1970).

iptors: *Maryland, *Oysters, *Clams, *Ad- rative agencies, Legislation, Shellfish, State nments, Aquatic animals, Commercial shellf- Commercial fishing, Regulations, Fishing, aspects, Invertebrates, Dredging.

mendment to Maryland law concerning tak- oysters and clams prescribes tonging seasons redging restrictions. In addition, the Depart- of Chesapeake Bay Affairs is authorized to rarily close any natural oyster bed in selected ies without public hearing. The Department is rmore directed to adopt regulations to insure he hydraulic clam dredge license of privileges ot abused. Areas in which it is prohibited to ysters or clams with other than hand tools are ribed. Also, restricted areas in specified coun- re prescribed. The amendment additionally ribes: (1) powers, duties, and provisions for ing of dealers and shippers by the Depart- (2) authorization for suspension and revoca- l licenses; (3) a severance tax levy; (4) penal- violations of the law; (5) county advisory committees; and (6) authorization for seizure and disposition of clams caught, sold, or held in violation of the law. (Hart-Florida)
W71-06050

CONTROL OF RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT.
Atomic Energy Commission, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-06051

VIEWS OF THE GOVERNORS ON TAX INCENTIVES AND EFFLUENT CHARGES (WATER POLLUTION CONTROL AND ABATEMENT).
For primary bibliographic entry see Field 05G.
W71-06052

WATER POLLUTION PROBLEMS AND CONTROL PROGRAMS IN MICHIGAN'S PORTION OF THE GREAT LAKES.
Michigan Water Resources Commission, Lansing.
For primary bibliographic entry see Field 05G.
W71-06053

WATER QUALITY STANDARDS.
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-06054

THE ENFORCEMENT PHASE OF POLLUTION ABATEMENT: THE ROLE OF THE ARMY ENGINEERS,
For primary bibliographic entry see Field 05G.
W71-06055

BLACK V TOWN OF BESSEMER CITY (DAMAGE TO LAND BY SEWAGE PLANT).

197 NC 195, 148 SE 29 (1929).

Descriptors: *North Carolina, *Cities, *Water pollution, *Sewage disposal, Eminent domain, Damages, Land, Real property, Remedies, Water pollution sources, Water pollution effects, Legal aspects, Judicial decisions, Legislation, Local governments, Sewage, Wastes, Diversion, Air pollution, Waste treatment, Waste disposal.

Plaintiff sought damages for injury to his property resulting from the erection of defendant town's sewage disposal plant. Plaintiff contended that he was damaged by the diversion of sewage water into a stream running through his land and by pollution of the stream and the atmosphere. The trial court ruled for defendant and plaintiff appealed, contending that he was entitled to at least nominal damages for injury done his land by pollution of the stream. The Supreme Court of North Carolina affirmed. Plaintiff's contention would have been correct but for a statute giving cities the right to establish sewer systems, implemented by the power of eminent domain. Thus plaintiff was not entitled to damages as a matter of law. (Dye-Florida)
W71-06086

DASHNER V WOODS BROS CONST CO (IMPLEMENTATION OF RIVER PROTECTION PROJECT).
217 NW 464-468 (Iowa 1928).

Descriptors: *Iowa, *Administrative agencies, *Erosion, *River training, Levees, Flood control, Drainage systems, Construction, Plans, Surveys, Contracts, Legislation, Benefits, Assessments, Land tenure, Rivers, Missouri River, Banks, Shores, Dams, Shore protection, Topography, Remedies, Legal aspects, Judicial decisions

Plaintiff landowners sought to prevent payment to defendant construction company for improvements along the Missouri River and to prevent assessment of landowners in a drainage district to pay for improvements. Pursuant to the Iowa drainage law, plaintiffs, among others, had petitioned for creation of a river protection district and for construction of improvements to prevent erosion of the banks of the Missouri River. Plaintiffs alleged that the board of supervisors exceeded its authority in carrying out the improvements and that there was not adequate compliance with the contract, plans, and specifications. The trial court dismissed plaintiffs' petition and the Supreme Court of Iowa affirmed. Evidence showed that the board carried out the improvements in a proper manner. The river banks were constantly changing due to erosive and cutting action of the water. It was proper for the board to appoint engineers with power to submit plans and determine the nature and location of necessary improvements. The board and all interested parties inspected the work as it progressed, and no objection was raised until after the project was finished. The board accepted the improvements, and, in the absence of fraud, plaintiffs could not now cancel payment for the work. (Duss-Florida)
W71-06087

HOWES V TOWN OF BARNSTABLE (OWNERSHIP OF CLAM BEDS).
285 Mass 361, 189 NE 34-37 (1934).

Descriptors: *Ownership of beds, *Massachusetts, *Clams, *Public rights, Land tenure, Shellfish, Land, Shores, High water mark, Permits, Damages, Legislation, Cities, Commercial shellfish, Legal aspects, Judicial decisions, Channels, Marshes.

Plaintiff sought to enjoin defendant town and others from interfering with his clam fishery located on a sand flat. Plaintiff further sought damages for the taking of clams and injury to the fishery. Plaintiff had acquired exclusive right to dig clams on the flat for a term of years. This right expired and was not renewed by the town. Plaintiff continued to dig clams without a permit and sought to acquire title to the area by acquiring two quitclaim deeds. Plaintiff also claimed that he acquired an adverse title as against all but the true owners by putting nets and signs around the flat signifying his ownership. The master dismissed plaintiff's bill and the Supreme Judicial Court of Massachusetts affirmed. Plaintiff failed to sustain the burden of proving his title to the premises. The evidence did not show that plaintiff's grantors possessed any interest in the property. The spreading of nets and erection of signs without inclosure, permit, or legislative sanction was ineffective to destroy the public right to take shellfish from the disputed area. Plaintiff's efforts at propagation and cultivation during the life of his license did not give him any rights in the fishery against the town after expiration of his permit. (Duss-Florida—)
W71-06089

STATE V MIDDLETOWN HYDRAULIC CO (VALIDITY OF WATER RIGHTS RESERVATION IN GRANT OF CANAL PROPERTY TO STATE).
114 Ohio St 437, 151 NE 653-665 (1926).

Descriptors: *Ohio, *Water rights, *Canals, *Milldams, Dams, Riparian rights, Riparian waters, Riparian land, Sluices, Flumes, Diversion, Diversion structures, Contracts, Water contracts, Land tenure, State governments, Public land, Public rights, Water utilization, Preferences (Water rights), Legal aspects, Judicial decisions.

Plaintiff state brought a quo warranto action to challenge defendant corporation's right to divert and use water from a state-owned canal. Defendant contended that his predecessor's grant of the canal property to the state reserved the water rights for the operation of a mill and that both the state and defendant's predecessors had recognized and preserved this reservation of water rights for 100 years. Plaintiff argued that: (1) the canal commission had no authority to acquire less than a free simple and must have fee simple, having been in

possession for 100 years, and (2) the original water rights were not a reservation from the title but a grant by the state, personal to defendant's predecessor and expiring upon his death. Affirming a judgment for defendant, the Supreme Court of Ohio held that plaintiff's possession was in recognition, not exclusion, of defendant's water rights for 100 years and is conclusive of the state's interpretation of its power to hold less than a fee simple. The court also noted that the reservation for a specific purpose only limited the quantity of defendant's water rights and not the use to which he might apply the water. (Liptak-Florida)
W71-06098

COUNTY OF BECKER V SHEVLIN LAND CO (RIGHT TO CONNECT NAVIGABLE STREAMS WITH HIGHWAYS).

243 NW 433-434 (Minn 1932).

Descriptors: *Minnesota, *Navigable rivers, *Highways, *Access routes, Administrative agencies, Streams, Navigable waters, Lakes, Benefits, Costs, Right-of-way, Beds, Ownership of beds, Public rights, Legal aspects, Judicial decisions, Land tenure, Legislation.
Identifiers: *Constitutionality.

Plaintiff land company sought to prevent defendant county from constructing a connecting road between a stream and a public highway. Plaintiff contended that a state act authorizing construction of connecting roads with navigable streams was special legislation and thus unconstitutional. Plaintiff also contended that a patent from the United States, describing the river bed as among plaintiff's lands, conveyed title to the bed. Therefore, the state had no interest in it. The district court issued an order appointing commissioners to appraise benefits and damages consequent upon the taking of the right-of-way for the highway. The Supreme Court of Minnesota affirmed. The state act authorizing connecting roads with navigable streams was not unconstitutional. There was no impropriety in authorizing a highway which would provide access to navigable streams. Title to beds of navigable streams is in the state unless conveyed by the United States prior to the state's admission to the Union. Such a conveyance never occurred, and the government patent describing the river bed would not be construed as conveying title. Since the stream in question was navigable, and therefore public waters, the connecting road could be sustained as for a public purpose. (Duss-Florida)
W71-06099

SNOW AND RESERVOIR MANAGEMENT IN CANADA FOR THE COLUMBIA RIVER TREATY OPERATION,
British Columbia Hydro and Power Authority, Vancouver, Canada, Hydrology Branch.
For primary bibliographic entry see Field 02C.
W71-06134

QUINLAN V BOROUGH OF FAIR HAVEN (TITLE DISPUTE TO RIPARIAN LAND AND SUBMERGED LAND UNDER DOCK).

131 A 870-871 (NJ Ct Err and App 1926).

Descriptors: *New Jersey, *Docks, *Riparian land, *Ownership of beds, Piers, Riparian rights, Riparian waters, Roads, Public rights, Navigable waters, Shores, Banks, Prescriptive rights, Land tenure, Real property, State governments, Legal aspects, Local governments, Piles (Foundations), Jucidial decisions, Bulkheads.

Plaintiff riparian owner sued to eject defendant town from a road leading to a wharf and from submerged land over which the wharf was built. Plaintiff traced her title to the road through various deeds and her title to the submerged land to a riparian grant from the state. Defendant claimed title through: (1) a deed conveying all the right and title of a dock company which had used the land, and (2) adverse possession. Affirming a judgment for plaintiff, the Court of Errors and Appeals of New Jersey noted that the dock company's charter of incorporation gave it no title to land which it did not already own. Thus the company had no title to convey to defendant. The court also noted that defendant's possession of the submerged land was not adverse since: (1) the dock company's charter constituted an express license to use the land; and (2) title by prescription cannot be secured against the public, which held the property before its conveyance to plaintiff. (Liptak-Florida)
W71-06145

MILLER V COMMONWEALTH (TITLE TO VIRGINIA TIDAL MARSHES).
166 SE 557-567 (Sup Ct App Va 1932).

Descriptors: *Virginia, *Ownership of beds, *Tidal marshes, *Boundary disputes, Boundaries (Property), Legislation, Recreation, Legal aspects, Judicial decisions, Land, Real property, Marshes, Rivers, Banks, Riverbeds, Tidal waters, High water mark, Low water mark, Hunting, Riparian land, Land tenure, Beds, Beds under water, Streambeds.

In a criminal prosecution for unlawfully hunting on the lands of another without the owner's consent, defendant hunter was convicted. The land on which defendant had hunted lay between the high and low water marks on the banks of the James River. Defendant contended that the owner of the upland did not own the property on which he hunted. The Supreme Court of Virginia affirmed his conviction. Without specific language to the contrary, a Crown grant of uplands did not include the adjacent tidal marshes. However, an act of the legislature in 1819 granted the land between the high and low water marks to the holder of the adjacent uplands, where such land had not been used as a common by the public. A proviso in an act of 1792 reserving beds of rivers to the states applied only to conveyances made after 1792. The land in question was granted prior to 1760 and was never used by the public in common. (Dye-Florida)
W71-06161

OLIVER V CITY OF RICHMOND (COMPENSATION FOR STATE DIVERSION OF A NAVIGABLE STREAM).
178 SE 48-53 (Sup Ct App Va 1935).

Descriptors: *Virginia, *Diversion, *Eminent domain, *Navigation, Navigable rivers, Legal aspects, Judicial decisions, Condemnation, Damages, Land, Real property, Riparian rights, Navigable waters, Compensation, Riparian land, Rivers, Running waters, Ownership of beds, Governments, State governments, Federal government, Riparian waters, Alteration of flow, Public rights.

To improve navigation defendant city sought to divert the waters of a navigable river into an artificial channel. Plaintiffs claimed a property right in the river's current and sought compensation for the decrease in value of their property resulting from defendant's diversion. Plaintiffs contended that only Congress was empowered to improve navigation without compensating landowners for depriving them of access to the flow. The Supreme Court of Appeals of Virginia reversed a judgment for plaintiffs. Beds of navigable rivers belong to the state. Riparian owners' right to a normal flow of water in a river's natural course is subject to the government's power to improve navigation. Where the government exercises its right to improve navigation, only those landowners whose properties are taken must be compensated, not those who are being deprived of an incidental and subservient right. Deprivation of such rights is not a taking requiring compensation, whether accomplished by the federal government or a state. (Dye-Florida)
W71-06162

GEORGE F FISH FARMS V STATE (STATE LIABILITY FOR FLOODING FARM).
135 Misc 188, 237 NYS 383-390 (Ct Cl 1929).

Descriptors: *New York, *Flooding, *New Yo State Barge Canal, *State governments, Cana Condemnation, Eminent domain, Compensatio Payment, Crops, Water injury, Flood damag Damages, Riparian land, Ditches, Drainage, Leg aspects, Judicial decisions, Farms, Dams, Rainfa Lakes, Littoral, Agriculture, Muck soils.

Plaintiff lessee sued defendant state for damag caused by flooding. Plaintiff leased muckland ne a lake, prepared it, and planted vegetables. Th tract was drained by a ditch to the lake. The lak rose into the ditch, flooding the land and destroyin plaintiff's crops, although flooding had not o curred before. The lake was part of a barge cana and defendant had constructed a dam downriv from the lake, raising its level about 2 1/2 fee Various riparian owners were then compensate for flooding, after two test decisions. Plaintiff con tended that these decisions required that defendar be held liable, but defendant asserted that sinc plaintiff's tract was not on the lake and the floo was caused by rainfall, it was not liable. After no ing that the proper measure of damages was renta value, plus preparation and planting costs, th Court of Claims of New York stated that it was im material that plaintiff's tract was not littoral. Deter mining the evidence sufficient to establish that th dam caused plaintiff's injury, the court held tha the prior decisions were binding and adjudged de fendant liable. (Hart-Florida)
W71-06163

COLONNA V STATE (DAMAGES FOR FLOODING OF QUARRY).
146 Misc 762, 262 NYS 846-847 (Ct Cl NY 1933).

Descriptors: *New York, *Damages, *Cana seepage, *Quarries, Leakage, Seepage, New York State Barge Canal, Legal aspects, Judicial decisions, Canals, Land, Real property, Pumping, De watering, Pumps, Drainage, Submergence.

Defendant state maintained a barge canal from which water seeped into plaintiff's quarry. Plaintiff sought as damages the value of stone which could have been removed from the quarry during each year of the seepage. The Court of Claims of New York affirmed a judgment for plaintiff in a reduced amount. Plaintiff could have operated the quarry during each of the years in question by pumping the water from the premises. He was entitled only to the cost of pumping sufficient water from the quarry to carry on his business, including depreciation of pumping equipment. If the quarry had actually been in operation over the period of the injury, plaintiff would have been entitled also to the loss of production between working the quarry under wet conditions and under dry conditions. (Dye-Florida)
W71-06164

CRAGE V CITY OF BUFFALO (DUTY OF CITY TO PROVIDE FOR SEWAGE DISPOSAL).
148 Misc 298, 265 NYS 640-643 (Sup Ct 1933).

Descriptors: *New York, *Cities, *Sewage disposal, *Canals, Easements, Sewers, Channels, Legal aspects, Judicial decisions, State governments, Local governments, Damages, Remedies, Wastes, Disposal, Open channels, Sewage, Waste disposal, New York State Barge Canal, Land, Landfills, Public health, Leases, Rent, Prescriptive rights.

Plaintiff owned property on a bank of the Erie Canal. While the canal was in existence, plaintiff passed sewage from his property into it. The state abandoned the canal and conveyed the canal property to defendant city. Defendant filled the canal, leaving a narrow channel of running water on each side of the fill. Plaintiff continued to pass sewage into one of these channels, but the current therein

is insufficient to carry solid wastes. Solid waste cumulated, creating a noxious odor which in- ced plaintiff's tenants to move. Plaintiff sued for s lost rentals, contending that: (1) his use of the nal to dump sewage had created in him a escriptive right to do so; (2) defendant, on filling e canal, was obligated to provide alternate means r disposal of sewage from plaintiff's land; and (3) fendant's action in leaving channels open nounted to establishment to a sewage system, nich, once created must be maintained in a oper manner. The complaint was dismissed. No escriptive right arose. Defendant was not ligated to provide plaintiff with sewage facilities. reation of the channel was incidental to filling the nal and not the creation of a sewer system. (Dye- orida)
71-06170

IRK V MAUMEE VALLEY ELECTRIC CO EASE OF WATER RIGHTS IN CANAL SUB- CT TO STATE'S RIGHT TO ABANDON ANAL).
9 US 797, 49 Sup Ct 507-510 (1929).

escriptors: *Canals, *Hydroelectric plants, Vater rights, *Water contracts, Surplus water, ontracts, Leases, Ohio navigation, Navigable aters, State governments, Legislation, Cities, ondemnation, Legal aspects.

aintiff hydroelectric power company sued to en- in defendant state public works supervisor from aining a canal, thereby stopping the supply of rplus water to plaintiff's power plant. Plaintiff ntended that draining the water was an impair- ent of the state's contract obligations under ases and grants of surplus water rights to plaintiff d amounted to taking plaintiff's property without ue process. Reversing a decree for plaintiff, the upreme Court of the United States noted that the atutes authorizing surplus water leases provided r cancellation only if hydroelectric production in- rfered with navigation or if the surplus water was eeded to improve navigation. However, the court eld that the statutes did not impose a duty on the ate to maintain the canal, and the state could andon the canal when no longer needed for avigation purposes without impairing plaintiff's ghts, since those rights were only incidental to the ublic right of navigation. (Liptak-Florida)
71-06171

TATE OF NEW JERSEY V STATE OF ELAWARE (LOCATION OF DELAWARE IVER BOUNDARY BETWEEN NEW JERSEY ND DELAWARE).
91 US 361, 54 Sup Ct 407-416 (1934).

escriptors: *New Jersey, *Delaware, *Boundary sputes, *Ownership of beds, Navigable waters, avigable rivers, Delaware River, Bays, Estuaries, hannels, Thalweg, Beds, Legislation, Riparian ghts, Prescriptive rights, Riparian land, Judicial ecisions, Legal aspects, Beds under water, State overnments, Rivers.

laintiff New Jersey sought determination of the oundary between Delaware and New Jersey in arts of the Delaware River and Bay. In one con- oversy title to the bed of the river within a twelve ile circle was at issue. Plaintiff claimed: (1) that efendant's chain of title was defective, and (2) tle by prescription. The second controversy in- olved the boundary line between the states in the ver below the circle and in the bay. Plaintiff laimed that the boundary between the states was ne thalweg. Defendant claimed title to the geo- raphical center. The Supreme Court of the United tates found for defendant in the first controversy nd for plaintiff in the second. First, defendant's tle derived from a valid patent of the British rown. A compact between New Jersey and elaware concerning various rights in the elaware River did not affect title in this area. laintiff never acquired title by prescription to the isputed area. Secondly, international law locates river boundaries between states at the middle of the channel as defined by the thalweg and not at the geographical center. The same doctrine applies to estuaries and bays where a dominant sailing channel can be found. (Duss-Florida)
W71-06172

COLGATE V PHILADELPHIA ELECTRIC POWER CO (CONSTITUTIONALITY OF CONDEMNATION OF PENNSYLVANIA LAND FOR OVERFLOW FROM MARYLAND DAM).
20 F2d 263-264 (ED Pa 1927).

Descriptors: *Pennsylvania, *Maryland, *Eminent domain, *Hydroelectric power, Electric power production, Electric power industry, Backwater, Damsites, Design flood, Hydroelectric plants, Water law, Remedies, Maximum probable flood, Real property, Condemnation, Compensation, Dams, Legal aspects, Judicial decisions.
Identifiers: *Constitutionality.

Plaintiff landowner sought to enjoin defendant power company from condemning his land. The land was in Pennsylvania, but was to be condemned for overflow by backwater from a Maryland dam for the benefit of a Maryland corporation. Plaintiff contended that a taking by defendant Pennsylvania corporation for the benefit of a Maryland corporation was not for a public purpose in Pennsylvania and was hence unconstitutional. It was determined that the Maryland damsite was the only one available, and that the Maryland company was formed for the sole purpose of satisfying Maryland law. The power generated was to be used to serve the Pennsylvania public. Hence the federal district court rejected plaintiff's assertion and dismissed the complaint. (Hart-Florida)
W71-06173

UNITED STATES V HAYES (TITLE TO STREAMBED FORMERLY PART OF INDIAN RESERVATION).

20 F2d 873-890 (8th Cir 1927).

Descriptors: *Ownership of beds, *Oil, *Boundary disputes, *Indian reservations, Boundaries (Property), Land tenure, Real property, Civil law, Riparian land, Non-navigable waters, Intermittent streams, Legal aspects, Judicial decisions, Beds under water.

Plaintiff United States brought action to determine title to streambeds in a non-navigable river. The river passed through what was formerly the Creek Indian reservation; oil had been discovered under the river bed. In the original treaty between plaintiff and the Creeks, the Creeks were recognized as a self-governing nation within the United States, and all the lands of the tribe were jointly owned by its members. This scheme proved unworkable, and the lands were alloted in fee among the members. Other portions were purchased outright. These various landowners claimed title to the thread of the stream, while plaintiff contended that the streambeds were reserved to the Creek nation in the allotment and purchase deeds. The Eighth Circuit Court of Appeals noted that under both common and civil law, without consideration of the intent of the parties, the conveyance would extend to the thread of the stream. However, determining that the parties' intent prevailed, the court undertook an extensive examination of the allotments and held that the parties had never intended to reserve the streambed to the non-existent Creek Nation. Accordingly, title of the various riparian owners was held to extend to the thread of the stream. (Hart-Florida)
W71-06177

HOGUE V STRICKER LAND AND TIMBER CO (NAVIGABLE RIVER AS BOUNDARY BETWEEN STATES).
2 F Supp 905-908 (SD Miss 1933).

Descriptors: *Mississippi, *Louisiana, *Boundary disputes, *Boundaries (Property), Accretion, Mississippi River, Islands, Navigable rivers, Channels, Judicial decisions, Legal aspects, Riparian rights, Riparian land, Alteration of flow, Adjudication procedure, Rivers, Erosion.

Plaintiff owned property fronting on the east side of the Mississippi River. The river shifted westward toward the Louisiana side, depositing accretions to plaintiff's mainland. An island on the Louisiana side of the river became connected to the Mississippi shore when the main channel of navigation in the river, forming the boundary between the states, changed from one side of the island to the other. Plaintiff brought an action to fix boundaries relative to the island and the accretions. Defendant Louisiana timber corporation claimed that the island was within the state of Louisiana. The federal district court held that while the navigable river forming the boundary between the states was gradually shifting, the boundary between the riparian parties as well as between the states shifted with the river. However, when the main channel of the river changed from one side of the island to the other the boundary between the states did not shift, but remained in the center of the old channel as it was when the water ceased to flow continuously therein. (Powell-Florida)
W71-06178

APPALACHIAN ELECTRIC POWER CO V SMITH (FEDERAL POWER COMMISSION'S POWER TO REGULATE PROJECTS ON NON-NAVIGABLE RIVERS).
4 F Supp 6-25 (WD Va 1933).

Descriptors: *Federal Power Act, Navigable waters, *Non-navigable waters, *Administrative agencies, Administrative decisions, Permits, Rivers and Harbors Act, Legislation, Navigable rivers, Flow, Federal project policy, Projects, Obstruction to flow, Dams, Reservoirs, Ownership of beds, Regulation, Federal government, Federal jurisdiction, Navigation, Legal aspects, Judicial decisions, Interstate.
Identifiers: Interstate commerce.

Plaintiff power company sought to enjoin defendant Federal Power Commission from acting unlawfully in approving plaintiff's proposed power project. Defendant, under the Federal Water Power Act, had offered to issue plaintiff a standard license under the Act after a finding that the project would affect interstate commerce. Plaintiff refused this license, claiming that the Commission was without jurisdiction over the project. Plaintiff offered to accept a less stringent license complying with the protection afforded navigation under the Rivers and Harbors Act. The project was to be build on a non-navigable river which fed into a navigable river. Defendants moved to dismiss plaintiff's bill and the federal district court granted the motion. Under the Act, Congress is without jurisdiction over non-navigable streams not in public lands or reservations of the United States where obstruction of such streams would not affect interests of interstate or foreign commerce. However, upon application for a project, it is for the Commission to determine whether interests of interstate or foreign commerce would be affected by such construction. Though courts are not bound by the Commission's findings, in this instance their finding that the proposed project would affect interstate or foreign commerce on a navigable river was supported by the evidence. (Duss-Florida)
W71-06183

WATER-USE LAW AND ADMINISTRATION IN WISCONSIN,
Wisconsin Univ., Madison. School of Law.
Harold H. Ellis, J. H. Beuscher, Cletus D. Howard, and J. Peter DeBraal.
Wisconsin Univ Extension, Madison, Department of Law, 1970. 720 p, 6 fig, 11 tab, 8 append.

Descriptors: *Water law, *Wisconsin, *Legal aspects, *State jurisdiction, *Federal jurisdiction, Judicial decisions, Jurisdiction, Ownership of beds, Reparian rights, Public rights, Administrative decisions, Regulation, Water users, Admiralty, Water rights, Eminent domain, Overlying proprietor, Preferences (Water rights), Water rights, Economics.
Identifiers: *Private water rights, State agencies, Constitutional aspects, Evaluating water laws.

This book is a concise summary of legal aspects pertinent to water use in Wisconsin. It emanated from some 20 years investigations conducted by the University of Wisconsin Law School, partially under a four year contract between the University and the Department of Agriculture. The 19 chapters of the volume incorporate the following subject matter relevant to one of the major resources of the state: division of water; private rights to use water courses, diffused water, and groundwater; protection of water rights; public rights to use navigable waters; the role of state agencies, particularly the Department of Natural Resources, in control of water level and pollution; the role of local government in the disposition of water; federal, interstate, and international rights in the use of water; evaluation of water laws. The appendixes provide illustrative legal decisions. The volume is a source book for all concerned with the use of water, including the riparian owners, irrigation farmers, industrialists, lawyers, administrators, and conservationists. Although the book deals primarily with Wisconsin, the experiences in this state may suggest solutions of water law problems in other areas. (Wilde-Wisconsin)
W71-06192

GEORGE W ARMBRUSTER, JR, INC V WILDWOOD (EFFECT OF BEACH EROSION AND ACCRETION UPTON TITLE TO RIPARIAN LAND).

41 F2d 823-831 (D NJ 1930).

Descriptors: *Accretion (Legal aspects), *Roads, *Riparian land, *Cities, Erosion, Beach erosion, Land tenure, Real property, Oceans, Atlantic Ocean, Legal aspects, Judicial decisions.

Plaintiff riparian owner sought to enjoin defendant municipality from maintaining a boardwalk on the bed of an avenue. Plaintiff contended that the boardwalk hindered his right of ingress and egress from his land on the ocean side of the avenue. In the course of its decision, the court noted the erosion and later accretion of plaintiff's land and the roadbed did not affect the dedication of the avenue or plaintiff's title. (Hart-Florida)
W71-06195

IMPLICATIONS OF WATER QUALITY LAWS FOR THE FEEDLOT INDUSTRY,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.
W71-06222

WATER, WATER EVERYWHERE---BUT: A STUDY OF THE POLITICO-ADMINISTRATIVE ASPECTS OF WATER DEVELOPMENT IN MONTANA,
Montana State Univ., Bozeman. Water Resources Research Center
Richard G. Sheridan.
Montana University, Joint Water Resources Research Center Report No 9, June, 1968. 286 p, 16 tab, 8 charts. WRR Project B-004-MONT (3)

Descriptors: *Montana, *Political aspects, *Legal aspects, *Water policy, *Administrative agencies, Prior appropriation, Leadership, Coordination, Economics, Management, Water allocation (Policy), Water rights, Beneficial use, Water law, State jurisdiction, Federal-state rights conflicts, State governments, Reasonable use.
Identifiers: *Administrative problems, Administrative aspects.

Montana is a water-abundant state, the water resources of which are extremely important to its economy. In this comprehensive report, all agencies and officials dealing with water resources administration and development are listed and discussed. The hierarchy of control over the state's water resources is outlined. The author believes that the present type of water resources management is duplicative, unwieldy, and inefficient. He outlines some of Montana's long-standing water problems and suggests new solutions. Water rights in Montana are basically modeled on prior appropriation, which can lead to waste and does not guarantee beneficial use. Irrigation, heavily subsidized by the federal government at a time when non-planting of crops is also subsidized, is wasteful of water. Recreational use should be the prime purpose of water resources in the west. The author then erects a model system of water resources administration for the state designed to be capable of handling efficiently the problems he has discussed. (Yensen-Arizona)
W71-06226

CONNECTICUT WATER LAW: JUDICIAL ALLOCATION OF WATER RESOURCES,
Connecticut Univ., Storrs. Inst. of Water Resources.
Robert I. Reis.
Report No 4, 1967. 215 p, 6 append. OWRR Project A-012-CONN (2).

Descriptors: *Connecticut, *Water law, *Water resources, *Riparian rights, Navigable waters, Non-navigable waters, Reasonable use, Dams, Ownership of beds, Diversion, Riparian land, Riparian waters, Water pollution, Water supply, Condemnation, Damages, Public health, Public rights, Legal aspects, Prescriptive rights, Navigation, Federal-state water rights conflicts, Recreation, Groundwater, Surface waters.

The first of four parts in this work discusses riparian rights in non-navigable waters; the discussion includes: (1) the nature of riparian rights, tracing the evolution of the reasonable use doctrine, including the prior occupation and natural flow theories; (2) specific reasonable use controversies, such as detention and dams, diversions, and non-municipal water pollution; (3) recreational use; (4) acquisition and protection of municipal water supplies; (5) municipal liability for sewerage, accelerated stream flow, and pollution; (6) extinction of the riparian right and loss of the 'right' to exercise existing riparian rights by estoppel, condemnation, and prescription; and (7) littoral rights on lakes and ponds. The doctrines of public and private rights in navigable waters are discussed in part two. Topics considered are: (1) the navigation doctrine, including a discussion of rules distinguishing navigable and non-navigable waters, (2) public rights in navigable waters; and (3) various riparian rights in navigable waters, including rights of access. Part three is devoted solely to groundwater, including both underground streams and percolating waters. Subjects included within the part four discussion of surface water are mills and ponds, sewerage assessments, and diffused surface water. (Hart-Florida)
W71-06273

DELAWARE RIVER BASIN COMM'N HEARING TO EXPAND THE COMPREHENSIVE PLAN.
Federal Register, Vol 35, No 96, p 7671, May 15, 1970. 1 p.

Descriptors: *Interstate compacts, *Interstate commissions, *Sewage treatment, *Flood control, Sewage, Administrative agencies, Administrative decisions, Cities, Sewage districts, Governments, Local governments, Flood protection, Federal government

The Delaware River Basin Commission publish notice of hearings to be held to expand the Co prehensive Plan to include the following projec (1) a sewage collection and treatment system serve Mount Pocono, Pennsylvania; (2) a flo protection project for Tamagua, Pennsylvania; a (3) a project to improve and enlarge the Kiames Lake Sewer District treatment plant in Thompso New York. (Hart-Florida)
W71-06274

HEARING BY DELAWARE RIVER BAS COMM'N TO EXPAND THE COMPREHENSIV PLAN.
For primary bibliographic entry see Field 05G.
W71-06275

CERTIFICATES OF FINANCIAL RESPONSIBILITY (OIL POLLUTION).
Federal Register, Vol 35, No 250, p 19644 (De 25, 1970). 1 p.

Descriptors: *Administrative agencies, *Water pollution, *Administrative decisions, *Water pollutio sources, Pollutants, Pollution abatement, Wate pollution control, Federal government, Ship Regulation, Water quality, Non-structural alterna tives.
Identifiers: *Financial responsibility.

The Federal Maritime Commission publishe notice of an extension of time for owners or opera tors of certain barges to apply for a certificate o financial responsibility. The extension unti February 15, 1971, was granted because a commis sion order provides that an applicant desiring a cer tificate of financial responsibility for potentia damages of oil pollution under the Water Quality Improvement Act should apply no later tha December 31, 1970. However, requests for specia consideration will be granted if good cause i shown. Since certain barges which are not self propelled and do not carry oil as cargo may be ex empt from the Water Quality Improvement Act financial responsibility requirements by legislation pending in Congress, and since nonreturnable application fees are under consideration, the Commission considers good cause to exist ipso facto for non-oil-carrying, non-self-propelled barges. (Hart-Florida)
W71-06276

STATE WATER CONTROL LAW.

Va Code Ann secs 62.1-44.2 thru 62.1-44.34 (Supp 1970).

Descriptors: *Virginia, *Water quality control, *Water pollution control, *Administrative agencies, Legislation, Water policy, Administration, Adoption of practices, Regulation, Non-structural alternatives, Water pollution, Pollution abatement, Waste disposal, Sewage districts, Sewage disposal, Institutional constraints, State governments, Permits, Adjudication procedure, Decision making, Oil wastes, Oily water, Water conservation, Water management (Applied), Legal aspects.

In the interest of protecting and improving Virginia's water-quality standards, the duties, jurisdiction, and regulatory powers of the State Water Control Board are set forth in this legislation. Article One contains an enunciation of public policy regarding protection of water quality and regulation of waste discharge, and an affirmation of state control notwithstanding past discharges of waste. Article Two details the: (1) appointment, qualifications, and compensation of State Water Control Board members; (2) inspection and investigatory powers of the Board; and (3) general powers and duties of the Board. Article Three lists procedures regarding application for discharge permits and certification of industrial waste discharge. Article Four specifies the Board's powers over sewage treatment plants and facilities. Enforcement and appeal procedures, appearing in Article Five, in-

de: (1) enforcement by injunction; (2) rules of dence to be used by the Board; and (3) the right udicial review of Board action. Article Six con- ıs the penalties imposed for: (1) violation of a cial order of the Board, (2) violation of a condi- ı imposed by certification, and (3) failure to perate with the Board. The Board's power to ulate pollution from boats and to prevent the charge of petroleum products is detailed in Arti- Seven. (Earl-Florida)
1-06277

ATE BOARD OF HEALTH (DISPOSAL OF WAGE AND SOLID WASTES).
Code Ann secs 32-9 and 32-9.1 (Supp 1970).

scriptors: *Virginia, *Administrative agencies, ewage disposal, *Solid wastes, Ultimate disposal, ste dumps, State governments, Cities, Disposal, vage, Legislation, Legal aspects, Wastes, Local ernments, Administration.

s 1970 amendment to the Virginia code scribes that the State Board of Health may regu- methods of sewage disposal in the state. The rd is also authorized to consider and investigate sible devices to control discharge of human te from common carriers. In addition, the rd is required to promulgate regulations scribing methods for disposal of solid waste in h county, city, or town in Virginia. Each state division, upon request of the Board, is required ubmit a plan for solid waste disposal, including s to be utilized for disposal and cost and financ- arrangements. (Hart-Florida)
1-06278

ATER AND WASTE WATER WORKS ERATIONS (CERTIFICATION OF WATER D WASTE WATER OPERATIONS).
Code Ann secs 54-573.1 thru 54-573.17 (Supp 0).

scriptors: *Virginia, *Administrative agencies, ater works, *Personnel management, State ernments, Water conveyance, Water distribu- ı (Applied), Permits, Water supply, Administra- decisions, Legislation, Legal aspects, Waste er disposal, Waste water treatment, Waste tment, Waste water (Pollution), Public utilities, ter management (Applied), Interstate, Regula- ı, Personnel, Management.

oard of certification for waterworks and waste er works operators is created by this legislation. e act provides rules governing: (1) the composi- ı of the board; (2) quorum, meetings, examina- ıs, and expenses of board members; (3) issuance certificates and grounds for revocation; (4) ice and hearing prior to denial, suspension, or ocation of a certificate; (5) reciprocity between es for purposes of certification; (6) interim eration of works without a certified operator; (7) lection and disposition of fees for application l renewal; (8) operator classifications; (9) the pe of qualification examinations; (10) horization for the board to promulgate rules and ulations; (11) the effect of violating provisions the act; and (12) appeals from actions by the rd. Those holding certificates under a voluntary tification program or in charge of a works on uary 1, 1971, are automatically certified for two rs. (Hart-Florida)
1-06279

LEN V POTTER (RIGHT TO ERECT BOAT IST BELOW LOW WATER MARK).
5 NYS2d 790-793 (Sup Ct 1970).

scriptors: *New York, *Easements, *Riparian hts, *Right-of-way, Legal aspects, Boats, Boat- , Boat-launching ramps, Navigable waters, servation doctrine, Judicial decisions, Lakes, nership of beds, Riparian land, Riparian waters, blic rights.

Plaintiff easement owner brought action against defendant riparian landowner for damages and an injunction to prevent interference with plaintiff's use of a boat hoist located below low water mark in front of plaintiff's right-of-way. The easement was for 'ingress, egress, and regress with the right at all times. . .to pass or repass on foot and with animals or vehicles.' The determinative issue was whether plaintiff, as a member of the public, or as holder of the right-of-way, was entitled to maintain a hoist upon public land in the bed of navigable waters. The Supreme Court of New York stated: (1) a riparian (littoral) PROPRIETOR OWNS LAND ON THE BANK OF A RIVER OR LAKE; (2) riparian rights denote the right and profit appurtenant to the upland, subject to sovereign regulation for navigation; (3) riparian rights include: (1) use of water for bathing and domestic purposes, (b) wharfage to navigable waters, and (c) access to navigable waters. Riparian rights were held not to attach to plaintiff's easement. Furthermore, the court held that plaintiff's riparian rights as a citizen were not superior to defendant's, and plaintiff could not encrocah upon defendant's rights by maintaining the hoist. Accordingly, the complaint was dismissed. (Hart-Florida)
W71-06280

THE LAW OF WATER--INTRODUCTION; WATERCOURSES; PERCOLATING AND SURFACE WATERS.
In: Powell on Real Property, Vol 5, Matthew Bender and Company, New York, p 345-438 (1962). 94 p, 435 ref.

Descriptors: *Water law, *Watercourses (Legal), *Percolating water, *Surface waters, Repulsion (Legal aspects), Riddance (Legal aspects), Surface runoff, Drainage water, Natural flow doctrine, Alteration of flow, Reasonable use, Relative rights, Riparian rights, Diversion, Legislation, Remedies, Prescriptive rights, Water pollution, Drainage districts, Percolation, Subsurface runoff, Diffusion, Legal aspects, Prior appropriation, Civil law.

Three water law topics are considered in this treatise: (1) introduction to law of water; (2) watercourses, exclusive of appropriation and (3) percolating and surface waters, exclusive of appropriation. The introduction relates the scope and organization of the treatise. In the discussion of watercourses, the following areas are examined: (1) terminology; (2) English law of natural flow; (3) American law of reasonable use; (4) reasonableness of use, including purpose, destination, quantitative facts, pollution, alteration of flow, and other types of conduct; (5) alteration of permissible use by methods other than prescription; (6) alteration of permissible uses by prescription; (7) remedies; (8) state legislation (not including appropriation statutes); and (9) federal legislation. The percolating and surface waters section includes: (1) terminology; (2) percolating waters, including the English rule of unrestricted privilege, American evolution of reasonable use, California rule of correlative rights, and statutory conservation; and (3) surface waters, including the natural flow doctrine, common enemy approach, reasonable use, and statutory drainage districts. The three sections treated purport to cover the entire field of water law with the exception of the development and status of problems centering on the law of appropriation. (Hart-Florida)
W71-06281

GOVERNMENTAL RESPONSIBILITY FOR WASTE MANAGEMENT IN URBAN REGIONS,
For primary bibliographic entry see Field 05G.
W71-06282

SOIL AND WATER LOANS; LAND CONSERVATION AND DEVELOPMENT LOANS.
Department of Agriculture, Washington, D.C.

Code of Federal Regulations, Title 7, Chap XVIII, secs 1821.51 thru 1821.87 (1970). 8 p.

Descriptors: *Loans, *Farm management, *Water resources development, *Rural areas, Soil management, Costs, Federal government, Governments, Financing, Capital, Government finance, Investment, Credit, Conservation, Drainage, Forestry, Water management (Applied), Pastures, Pasture management, Water policy, Farms.

Pursuant to section 304 of the Consolidated Farmers Home Administration Act of 1961, provisions for soil and water loans are hereby established. Loan preferences and objectives are defined, and the qualifications for acquiring a loan are explained. Enumerated herein are the purposes for which such loans may be used. The following procedural and administrative requirements are considered: (1) terms of loans, (2) special requirements, (3) security requirements, (4) compliance with special laws and regulations, (5) loan processing and related functions, and (6) subsequent soil and water loans. Land conservation and development loans are provided in accordance with section 203 of the Appalachian Regional Development Act of 1965. The following are explained under land conservation and development loans: (1) eligibility; (2) loan purposes; (3) special requirements; (4) security requirements; and (5) procedures for making, approving, processing, and closing loans. (Robinson-Florida)
W71-06283

JACOBS V UNITED STATES (COMPENSATION FOR LAND RENDERED MORE SUSCEPTIBLE TO OVERFLOW).
45 F2d 34-39 (5th Cir 1930).

Descriptors: *United States, *Condemnation, *Backwater, *Easements, Compensation, Eminent domain, Payment, Contracts, Rivers, Farming, Riparian land, Riparian rights, Dams, Design flow, Navigable rivers, Legal aspects, Judicial decisions.

Plaintiff riparian landowner sought compensation for land which had become more susceptible to overflow after defendant United States had erected a dam downriver. Defendant offered to purchase a flowage easement from plaintiff, but plaintiff rejected the offer and filed the instant action. The Fifth Circuit Court of Appeals observed that plaintiff could only recover upon an implied contract theory. Since defendant had foreseen that plaintiff's land would be damaged and require compensation, an implied contract was found. Furthermore, it was noted that a riparian owner had the right to enjoy the natural flow of the river without the burden of an artificial hindrance. Hence, the court stated that no public easement could arise without grant, dedication, or condemnation with adequate compensation, and held that plaintiff was entitled to damages. (Hart-Florida)
W71-06296

JONES V LOUISVILLE AND NASHVILLE RY (RECOVERY FOR FLOOD DAMAGE BY CONTRIBUTOR THERETO).
233 Ky 152, 25 SW2d 31-32 (1930).

Descriptors: *Kentucky, *Culverts, *Remedies, *Flooding, Surface drainage, Obstruction to flow, Legal aspects, Judicial decisions, Damages, Highways, Local governments, Channels, Floods, Ditches, Surface waters, Drainage, Sediment, Railroads, Natural flow.

Plaintiff landowner sued defendants, a railroad, the county and another landowner, to recover damages for flooding of his property. The county had acquired a right-of-way for the state highway commission to build a new highway, but contended that it could not be liable for negligent construction. The other landowner build a culvert from the highway to the back edge of plaintiff's lot, but claimed that if plaintiff had not extended the culvert to a small ditch on the railroad's property, the flooding would not have occurred. The railroad, whose drainage ditch clogged, backing water up onto plaintiff's property, also asserted that the flooding would not have occurred if plaintiff had

not connected its ditch with the larger culvert, bringing sediment into the ditch. The lower court sustained the county's demurrer and directed verdicts for the other defendants. The Court of Appeals of Kentucky affirmed, saying one who contributes to his own injury cannot recover for his wrong. (Morris-Florida)
W71-06303

CITY OF HARRISONVILLE V W S DICKEY CLAY MFG CO (ENJOINING CITY'S SEWAGE DISPOSAL INTO STREAM AS TEMPORARY NUISANCE).
61 F2d 210-215 (8th Cir 1932).

Descriptors: *Sewage disposal, *Municipal wastes, *Water pollution, *Pollution abatement, Sewage treatment, Sewage, Treatment facilities, Cities, Sewage effluents, Local governments, Water pollution sources, Waste water disposal, Riparian rights, Riparian land, Riparian waters, Remedies, Damages, Property values, Compensation, Judicial decisions, Streams.

Plaintiff corporation sued to recover damages and to enjoin defendant city from discharging sewage into a stream which flowed through plaintiff's land, thereby destroying its use as rented pasture. Plaintiff contended that defendant's sewage disposal was a temporary nuisance which could be abated by improving defendant's treatment system and also claimed as damages the cost of cleaning and restoring the banks of the stream. Defendant argued that the nuisance was permanent since the city could be afford the improvements and contended that plaintiff could only recover the difference in the land's value before and after the discharge. The Eighth Circuit Court of Appeals noted that a city is not justified in discharging sewage to the injury of other landowners and held that the nuisance was temporary, entitling plaintiff to injunctive relief. However, the court held that plaintiff was not entitled to the cost of cleaning the bank since nature would do so once the nuisance was abated. The cost of cleaning the banks was out of proportion to the value of the land and the actual damage to the land. (Liptak-Florida)
W71-06304

TALLASSEE POWER CO V CLARK (RIPARIAN RIGHTS IN RIVER BED AND IN FUTURE FLOOD WATERS AND ALLUVIAN).
77 F2d 601-605 (6th Cir 1935).

Descriptors: *Riparian rights, *Accretion (Legal aspects), *Islands, *River beds, Dams, Hydroelectric plants, Navigable rivers, Rivers, Navigable waters, Beds, Natural flow, River flow, Reasonable use, Flood waters, Floods, Flood control, Overflow, Riparian land, Riparian waters, Silts, Sediments, Silting, Relative rights, Water rights, Legal aspects, Judicial decisions.

Plaintiff brought action to recover for damages to farm lands on an island he owned in a navigable river in Tennessee. Plaintiff contended that the damage was caused by defendant's hydroelectric dams in North Carolina. Plaintiff contended that the dams increased the flow of water in the river, thereby destroying a ford which was plaintiff's only means of access of the island, and that the dams eliminated the usual spring overflow of the river, thereby depriving plaintiff of the alluvion, silt, and sediments which were usually deposited on the island and greatly enriched the soil. Defendant contended that: (1) plaintiff had no vested right to the use of the river bed as a ford since riparian owners own only to the low water mark in navigable rivers; and (2) the sediment deposits were caused by unusual floods, which are common enemies, rather than annual freshets; and (3) riparian owners have no vested right to future deposits. The Sixth Circuit Court of Appeals noted that the law clearly limits riparian title to the low water mark and reversed a judgment for plaintiff as to the destruction of the ford. Noting that riparian owners have no vested right to future accretions along the shore, the court distinguished plaintiff's claim to future deposits on his own land and found that riparian owners have a right to the flow of ordinary flood waters. The court reversed the judgment for defendant as to the floods and remanded for trial, noting that liability must depend on whether the dams constituted an unreasonable use of defendant's riparian rights. (Liptak-Florida)
W71-06305

THE BUREAU OF RECLAMATION'S ROLE IN AMERICA'S GROWTH,
Bureau of Reclamation, Washington, D.C.
Ellis L. Armstrong.
Water Resources Bulletin, Vol 7, No 1, p 175-184, February 1971.

Descriptors: *Water resources development, Land reclamation, Irrigation, Flood control, Recreation, Fish management, Wildlife management, Interbasin transfers.
Identifiers: *Bureau of Reclamation, *National development.

The Bureau of Reclamation was created to implement the Reclamation Act of 1902 and subsequent legislation to conserve and develop the water resources of the western states for maximum efficient use. This has been accomplished by the planning and construction of major multiple use projects which now supply water to approximately eight million acres of land which annually produce 52 million tons of food and fiber with a gross crop value of approximately $2 billion. Fifteen million people are served with municipal and industrial water supplies and hdyroelectric power from Bureau projects now returns $160 million annually to the Tresury. Flood control, recreation, and fish and wildlife enhancement are other major benefits. The Bureau of Reclamation is now undertaking a Westwide Survey of water resources and of the needs of the future which is more far-reaching than anything heretofore accomplished. The information accumulated during this ten-year survey will determine whether there is a necessity for consideration of major interbasin transfer of water supply. (Davis-Chicago)
W71-06308

LEGAL ASPECTS,
Iowa Univ., Iowa City. Coll. of Law.
For primary bibliographic entry see Field 05G.
W71-06446

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, ELBA, ALABAMA, PEA RIVER, WHITE WATER AND BEAVER DAM CREEKS.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-05867

FLOOD PLAIN INFORMATION, CALLEGUAS CREEK, VICINITY OF MOORPARK, VENTURA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W71-05868

ORGANIZING WATER POLLUTION CONTROL: THE SCOPE AND STRUCTURE OF RIVER BASIN AUTHORITIES,
Harvard Univ., Cambridge, Mass.
Marc J. Roberts.
Public Policy, Vol XIX, No 1, p 75-141, Winter 1971.

Descriptors: *Water pollution control, Decision-making, Water quality, Marginal cost, Economic evaluation, Economies of scale, Cost-benefit analysis, Prices, Riverbasin planning.
Identifiers: *Externalities, Regional planning, Social welfare function.

This paper explores the organization of deci making by governments on water pollution co The author outlines possible criteria to evalua gional institutions involved in water quality co One criteria cited requires that agencies be of cient scale to consider all relevant externa The problem of optimal institutional choi discussed with the author advocating a unified basin agency. The agency would levy se charges on industrial waste sources and have power to dispose of waste in the river basin. charges are set on the basis of the marginal co the system of maintaining water quality stand set by state and Federal agencies. The a discusses further complexities of regional w quality management often omitted from econ models of optimal choice. (Siegenthaler-Rutge
W71-05936

FLOOD PLAIN INFORMATION, KINGFIS AND UNCLE JOHN'S CREEKS, KINGFISH OKLAHOMA.
Corps of Engineers, Tulsa, Okla.
For primary bibliographic entry see Field 04A.
W71-06119

THE SOCIAL AND ECONOMIC NEED FLOODPLAIN REGULATION,
Soil Conservation Service, Denver, Colo.
For primary bibliographic entry see Field 04A.
W71-06131

FLOOD PLAIN INFORMATION, ONTONAG RIVER, ONTONAGON, MICHIGAN, AND LA SUPERIOR SHORELINE, ONTONAGON CO TY, MICHIGAN.
Stanley Consultants, Inc., Muscatine, Iowa.
For primary bibliographic entry see Field 04A.
W71-06232

ECOLOGY AND SPATIAL ANALYSIS,
Michigan Univ., Ann Arbor. Dept. of Geograph
James D. Clarkson.
Annals of the Association of American Ge raphers, Vol 60, No 4, p 700-716, December 19 2 fig, 33 ref.

Descriptors: *Ecology, *Methodology, *Envir mental effects, Theoretical analysis, *Plann *Water resources development, Geographical gions.
Identifiers: *Spatial analysis, Environmental de minism, Adaptive research.

This article examines some of the theoretical methodological considerations of importance water resources management and planning. Plac an ecological approach in the general framework American geographic thought indicates the use ness of distinguishing 2 trends in the developm of this thought--the one ecological, the other s tial. American geography tended to reject ecological approach because it was identified at early period with environmental determinism. spatial, non-functional, approach became dor nant. Although the two approaches are two ends a continuum, and thus connected, they arise fr and lead to different sets of questions which invo different approaches and different bodies theory. The ecological approach may be divid into four imprecise types--biological, human, c tural, and urban-political. The cultural-ecologi approach is particularly useful in analyzing obs cles to innovation acceptance in agricultu development because it emphasizes the analysis existent systems from different viewpoints. Fo sets of reality, or viewpoints, can be distinguish in this context--that of the scientist-observer, th of the change-agent, that of the cultivator, and th of the ideal-set of the cultivator. Only when t overlaps and conflicts of these sets are recogniz can a realistic appraisal be made. This is only a s gle instance of the potential of an ecological a proach. Spatial theory and ecological theory ha not yet been joined. The evident usefulness of bo indicates the importance of attempting such a joi

ng, and the futility of arguing for the ascendence of ne-over the other. (Davis-Chicago)
W71-06317

6G. Ecologic Impact of Water Development

HE ECOLOGY AND OCEANOGRAPHY OF EWER OUTFALLS,
cripps Institution of Oceanography, La Jolla, alif.
. A. Barnett, R. E. Davis, M. E. Silver, and R. R. Varner.
seminar held at Scripps Institution of Oceanogphy, Spring 1969. Scripps Institution of Oceanogphy, La Jolla, California, 1969. 19 p, 11 ref. SIO ef No 70-18.

escriptors: *Ecology, *Balance of nature, Oceanography, *Outlets, *Water pollution, Reviews, Effluents, Discharge, Water quality stanards, Food chains, Coastal engineering, Marine nimals, Marine microorganisms, California, Sea ater, Statistics, Sampling, Analytical techniques, nvironmental effects.
dentifiers: *Research objectives, *Research proram planning, Ecological effects.

special graduate seminar was held at Scripps in 969 to examine standards in use for defining 'pollion' in coastal waters of California, to survey exting and planned ocean outfalls, to determine hat type of investigations are required, and to exnine reports of a number of investigations for eir appropriateness and adequacy for the stated urpose. The participants of the seminar made the llowing recommendations: (1) all research roposals and/or contracts should be submitted to xternal, independent, objective referees; (2) more esearch and survey effort should be applied to roblems of: developing ecological 'indicators' of ollution, biochemical and physiological indices of ollution, measurement of the persistence of nonegradable fractions, particularly those of known oxicity, concentration factors in organisms, the atistical design of monitoring programs, methods f data analysis, review and presentation; (3) basic esearch needs to be done on: physiology of marine rganisms, sampling of marine organisms, commuty ecology and food chain structure, dynamics of oncentration factors through food chains, curents, turbulence, eddy diffusivity and mixing in the earshore regions; (4) there should be more cenalization of effort in the study of effects and reonal, long term planning of coastal waste sposal; (5) a great deal of effort needs to be put to the development of clear, unambiguous statements as to the standards to be maintained (or objectives to be met) for coastal water quality. Poertner)
W71-05928

AMAICA BAY AND KENNEDY AIRPORT: A ULTIDISCIPLINARY ENVIRONMENTAL TUDY.
maica Bay Environmental Study Group, N.Y.

ational Academy of Sciences, National Academy Engineering, Washington, DC, (1971). Two olumes, 23 fig, 2 map, 2 photo, 31 tab, 358 ref, 2 ppend.

escriptors: *Bays, *New York, *Airports, *Environmental effects, Ecology, Aquatic habitats, Environment, Fishing, Aquatic environment, Recreaon, Inlets (Waterways), Water pollution, Water ollution control, Pollution abatement, Sewage, redging, Runways, Pollutants, Landfills, Water ollution sources, Municipal wastes, Water polluon treatment, Administrative agencies, Estuaries, egal aspects.
dentifiers: *Jamaica Bay.

nder the auspices of the National Academy of ciences and the National Academy of Engineerg, the Environmental Studies Board produced this multidisplinary evaluation of the potential impact of the expansion of Kennedy Airport into Jamaica Bay. Dredging and landfills for airport and commercial construction have significantly altered Jamaica Bay, but it still functions as an imperfect marine environment and bird refuge. The benefits and costs of various means of improving air transportation are examined in the study, emphasizing that projected costs must include the value of ensuing environmental deterioration and diminution of the amenability of the area to residential and recreational development. Problems caused by sewage discharged into the Bay are also discussed. The roles of the various community, city, state, regional and federal agencies which must be involved in determining the future of the Bay area are examined. Regulatory solutions to the aircraft noise problem in the area surrounding the airport are discussed. The Board contends that regulatory measures controlling land use and inducing utilization of quieter planes are preferable to construction of more runways in Jamaica Bay. Further dredging and landfill would significantly worsen the environmental decay of the area, while not measurably improving the quality of air transportation above that level which may be obtained by alternative measures. (Hart-Florida)
W71-06045

07. RESOURCES DATA

7A. Network Design

A PROPOSED STREAMFLOW-DATA PROGRAM FOR NEBRASKA,
Geological Survey, Lincoln, Neb.
H. D. Brice, F. B. Shaffer, and N. G. Stuthmann.
Geological Survey open-file report 1970. 63 p, 4 fig, 16 tab, 14 ref.

Descriptors: *Streamflow, *Data collections, *Hydrologic data, *Surface waters, *Nebraska, Evaluation, Planning, Watershed management, Streams, Regression analysis, Flood plain zoning, Gaging stations, Runoff, Discharge measurement, Peak discharge, Average flow, Water quality, Environmental effects.
Identifiers: Streamflow characteristics, Peak discharge recurrence intervals.

An evaluation of the available discharge data for Nebraska streams was made to provide guidelines for planning the future data-collection program. The basic steps in this evaluation procedure were (1) definition of the long-term goals of the program in quantitative form, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate procedures and techniques to meet the remaining goals. In order to evaluate the stream records, regression analyses were made of discharge records at selected gaging stations. The analysis showed that application of the regression equations will not provide estimates of selected flow characteristics within the accuracy goals specified for either minor or principal streams. Proposals for changes in the present program include the conversion of some complete-record gaging stations to flood-record stations, establishment of additional complete-record stations on small drainage basins, and investigation of techniques for improving correlative estimates of low flow. Proposals also are made for expanding programs to protect the physical environment of streams. (Woodard-USGS)
W71-06128

THE SURFACE INSTRUMENT NETWORK OF THE UPPER COLORADO RIVER PILOT PROJECT,
Western Scientific Services, Inc., Fort Collins, Colo.
L. W. Crow, C. F. Chappell, and G. W. Jones.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 16-23, 1970. 8 p, 6 fig, 2 tab.

Descriptors: *Colorado River basin, *Weather modification, *Data collections, *Meteorological data, *Instrumentation, Precipitation gages, Networks, Evaluation, Water yield improvement.
Identifiers: San Juan Mountains (Colo).

The Upper Colorado River Pilot Project's goal is to augment precipitation in a 3,300 square mile area in the San Juan Mountains of southwestern Colorado through modification of wintertime cold orographic clouds. The first project phase, initiated in November, 1968, provided for installation and operation of a network of surface instruments to collect meteorological data to provide an understanding of the physical processes and sequence of storm events which occur in this area and to permit evaluation of precipitation augmentation operations. The instrument network design, procedures developed for areal distribution of precipitation, are discussed, and examples of precipitation patterns are presented. (See also W71-06133) (Knapp-USGS)
W71-06136

SNOW SURVEY TELEMETRY NETWORKS AND FUTURE PLANS,
Soil Conservation Service, Anchorage, Alaska. Water Supply Forecasting Branch; and Soil Conservation Service, Anchorage, Alaska. Snow Survey for Alaska.
William G. Shannon, and Ted G. Freeman.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, For Collins, p 98-101, 1970. 4 p.

Descriptors: *Telemetry, *Snowpacks, *Snowmelt, *Water yield, *Runoff forecasting, Snow surveys, Data collections, Hydrologic data, Runoff, Streamflow forecasting, Rainfall-runoff relationships.
Identifiers: *Snow survey telemetry.

To satisfy legislative, regulatory agency, and user demands for snowmelt water yield data, a telemetry system is proposed and its major properties are outlined. An ideal telemetry system would account for total precipitation, distribution, and depletions on a 'real time' basis for the total water-producing areas and their subwatersheds. Also, knowledge is needed to predict these same factors accurately for a future period. A scientist must prescribe the parameters to be collected, the frequency of sampling, and the distribution of stations or areal coverage before telemetry systems are designed and installed. The legislative authority and administrative policy must be compatible to achieve the overall objective. The electronic telemetry system should obtain and record information automatically on a preset time interval. The recorded information should be in such form that it can be processed by ADP techniques and retrieved from storage. The problem is to obtain, at a reasonable cost, hardware that is completely reliable and that operates unattended for nine months or longer at high-elevation data sites. This problem can be handled. (See also W71-06133) (Knapp-USGS)
W71-06148

THE AUTOMATIC HYDROLOGICAL RADIO REPORTING NETWORK, NEW ENGLAND DIVISION, CORPS OF ENGINEERS,
Office of the Chief of Engineers (Army), Washington, D.C. Civil Works Directorate.
Carleton H. Gray.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 102-107, 1970. 6 p, 5 fig.

Descriptors: *Flood forecasting, *Warning systems, *Telemetry, *Data collections, *Data transmission, Hydrologic data, Flood control,

Water levels, Flood protection, Reservoir operation, Data processing, Digital computers.
Identifiers: *Hydrologic data network.

As an integral part of a comprehensive plan of protection from flood hazards in New England area, the Corps of Engineers has designed an automatic data collection network. This radio operated network provides extensive hydrologic data including river, reservoir and tide levels, wind velocity and direction, barometric pressure and precipitation levels in five major New England river basins. At the central station the reporting network is interfaced directly with an IBM 1130 which can automatically interrogate the entire system and provide a complete printout in three minutes. (See also W71-06133) (Knapp-USGS)
W71-06149

7B. Data Acquisition

HYDROLOGY OF LIMESTONE TERRANES, PHOTOGEOLOGIC INVESTIGATIONS,
Geological Survey of Alabama University.
For primary bibliographic entry see Field 02F.
W71-05838

BOTTOM SEDIMENT SAMPLING,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
P. G. Sly.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 883-898, 1969. 16 p, 6 fig, 3 tab, 6 ref.

Descriptors: *Sampling, *Bottom sediments, *Lake Ontario, Great Lakes, Instrumentation, Equipment, Cores, Data collections, Core drilling, Sediments, Sedimentology, Surveys, Lakes.
Identifiers: *Bottom sediment sampling.

Tests with sampling equipment during 1967 and 1968 in Lake Ontario showed that some of the bottom samples were badly disturbed. As a result of these tests, further extensive trials of bottom sampling equipment were conducted in Georgian Bay in 1968. These were designed to test the disturbance of the bottom sediments caused by ship movement and to test the efficiency and suitability of various types of sampling devices. It was found that under typical sampling conditions, bottom disturbance was induced by the ship when the total water depth was less than about 6 m. It was also induced by the ship when the total water depth was less than about 6 m. It was also found that the ship, during typical sampling procedures in deeper water, induced disturbance in the water column, beneath it, to a depth of at least 14 m. Tests were conducted with three types of Gravity corer, two multiple corers, and six Grab samplers. These tests were designed to show their usefulness for both biological and geological samplings. All three gravity corers proved efficient for particular tasks. The most successful bottom grab samplers were found to be the Ponar grab and the Shipek bucket sampler. (See also W71-05561) (Knapp-USGS)
W71-05886

A STUDY OF FRESHWATER SAND GRAIN SURFACES BY SCANNING ELECT RON MICROSCOPY,
Illinois Univ., Urbana. Dept. of Geology.
Ronald D. Stieglitz.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 351-356, 1969. 6 p, 5 fig, 13 ref. NSF Grant GA-1239, PHS Grant PH-FR 07030.

Descriptors: *Sands, *Electron microscopy, *Sediments, *Lakes, *Dunes, Lake Michigan, Great Lakes, Sedimentology, Quartz, Mineralogy, Stratigraphy, Paleolimnology.
Identifiers: *Electron microscopes (Scanning).

Five samples of sand from several different environments were studied with the scanning electron microscope. Samples were taken from a small lake in Door County, Wisconsin, Lake Michigan beaches, dunes in Door County, and the Indiana dunes. Elaborate sample preparation is not necessary, and observation of shape and rounding as well as very small textures imprinted on the surfaces are possible. Large numbers of grains can be routinely examined so that major textures and grain types can be easily located and their frequency more accurately estimated. Quartz as well as other mineral grains were studied. Textures are distinctive and add much information concerning physical and chemical conditions in the depositional environment. Several quartz grains were etched in hydrofluoric acid for periods of 5 to 15 min to study the effects of chemical attack and crystallographic control on surface textures. (See also W71-05561) (Knapp-USGS)
W71-05887

INTERNAL WAVES OF THE SECOND VERTICAL MODE IN LAKE HURON,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02H.
W71-05896

SOME UNUSUAL SURFACE WATER TEMPERATURE PATTERNS IN THE GREAT LAKES, AS DETECTED BY AIRBORNE RADIATION THERMOMETER SURVEYS,
Meteorological Service of Canada, Toronto (Ontario).
J. G. Irbe.
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 583-607, 1969. 25 p, 21 fig, 5 tab, 25 ref.

Descriptors: *Water temperature, *Water circulation, *Great Lakes, *Weather, *Remote sensing, Aircraft, Lake Ontario, Lake Erie, Meteorology, Data collections, Thermometers.
Identifiers: Airborne radiation thermometry.

Since 1966 the Meteorological Service of Canada has undertaken a program of monthly surface water temperature surveys of the Great Lakes bordering on Canada using an airborne infrared temperature sensing instrument. During the three year period that the program has been in progress, many interesting features of the distribution of surface water temperature have been found. Maps showing some of the more unusual isotherm patterns deduced from these surveys are presented and discussed with reference to lake circulation and meteorological conditions. (See also W71-05561). (Knapp-USGS)
W71-05898

LARGE-SCALE DIFFUSION STUDIES AT NIAGARA RIVER MOUTH, LAKE ONTARIO,
Canada Center for Inland Waters. Department of Energy, Mines and Resources, Burlington (Ontario).
C. R. Murthy
In: Proceedings Twelfth Conference on Great Lakes Research, May 5-7, 1969, University of Michigan, Ann Arbor: International Association for Great Lakes Research, p 635-651, 1969. 17 p, 17 fig, 10 ref

Descriptors: *Mixing, *Lake Ontario, *Dispersion, *Diffusion, Dye releases, Tracers, Rivers, Streamflow, Current meters, Water circulation, Currents (Water), Great Lakes, Sampling, Fluorometry.
Identifiers: *Niagara River.

Some results of large scale dye plume experime conducted during the summer of 1968 at the mo of the Niagara River, Lake Ontario, are present Cross-plume concentration and diffusion cha teristics of the dye plume at the river mouth w analyzed. Based on the observed data from a c tinuous point source investigation, it appears t the efflux from the river is rapidly mixed with main body of the lake, possibly due to the co bined action of large scale convective eddies of stream in the early stages of diffusion (correspo ing to river mixing) and the regular dispersal due lake currents and turbulence at later stages. (S also W71-05561). (Knapp-USGS)
W71-05901

FORMATION EVALUATION BY INSPECTI WITH THE BOREHOLE TELEVIEWER,
Mobil Research and Development Corp., Dall Tex.
J. Zemanek.
Geophys, Vol 35, No 2, p 254-269, Apr 1970. 16 13 fig, 7 ref.

Descriptors: Geophysics, Seismic investigatio *Boreholes, Fissures, Measurement, Field te *Borehole cameras, *Borehole geophysics, *W logging, *Television, Geologic investigatio *Geophysical prospecting, *Orientation, *Fra tures (Geology).
Identifiers: Site selection.

The televiewer takes an oriented acoustic pictu of the inside of the borehole in the form of a co tinuous well log using high-frequency sound (abo 2 megahertz). The resulting log is a representati of the borehole wall as if it were split vertical along magnetic north and laid out flat. Induct and natural fractures are defined. Well bores c be filled with any homogenous liquid (oil, water, drilling mud). Resolution of the tool is sufficient locate fractures 1/32 in. wide. Examples of natur fractures, drilling-induced fractures, and fractu orientation are discussed. (USBR)
W71-05916

INVESTIGATIONS OF THE TECHNIQUES O PURIFICATION OF ALGAL CULTURES ELABORATION OF METHODS APPLICABL TO DESMIDS, FILAMENTOU CYANOPHYTES, AND DIATOMS, (I FRENCH),
Centre National de la Recherche Scientifique, Gi sur-Yvette (France). Centre de Recherche Hydrobiologiques.
M. Tassigny, G. Laporte, and R. Pourriot.
English summary. Annales de l'Istitut Pasteur, Vo 117, No 1, p 64-75, 1969. 2 tab, 22 ref.

Descriptors: *Laboratory tests, *Algae, Cultures Diatoms, Cyanophyta, Bioassay, Test procedures.
Identifiers: *Pure algal cultures.

Several methods of obtaining pure cultures of alga were subjected to critical review: dilution and us of pipettes, dilution following an ultrasonic treat ment, use of antibiotics, and germination of steril ized spores. Each of these methods offered a possi bility of obtaining pure cultures of a limited number of species. The simple technique of dilu tion and use of pipettes provided the greatest chance of success. A proper choice of the method and certain modifications permitted isolation o Microsteriae, Closterium, Draparnaldia, Nitzschia, and several filamentous Cyanophyceae. (Wilde Wisconsin)
W71-06002

EVALUATION OF AN AUTOMATIC CHEMI-CAL ANALYSIS MONITOR FOR WATER QUALITY PARAMETERS,
New York State Dept. of Health, Albany. Div. of Labs and Research.
For primary bibliographic entry see Field 05A.
W71-06005

INFRARED PHOTOS CAN MAP SOILS,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
Larry J. Cihacek, and James V. Drew.
Quarterly Serving Farm, Ranch, and Home, Vol 17, No 1, Spring 1970, p 4-8. 9 fig.

Descriptors: *Remote sensing, *Infrared radiation, *Soil-water-plant relationships, *Soil surveys, *Eluvium, Moisture stress, Drainage, Light penetration, Flood irrigation, Harvesting, Correlation analysis, Color, Aerial photography, Maps, Moisture availability, Photosynthesis, Valleys, Marshes, Humus, Seasonal, Precipitation, Soil moisture, Water table, Radiation, Range management, Soil management, Nebraska, Satellites (Artificial).
Identifiers: Leaf geometry, Mowing, Sand Hills (Neb), Semi-arid lands.

Infrared photos from remote sensing satellites of Nebraska's semi-arid Sand Hills help map soils for decisions in soil and range management. Soil, vegetation and water relations allow the mapping of this 19,300-square-mile area because of their ability to reflect invisible, near-infrared radiation. Soil differences across this wind-blown region are due to variations in soil moisture and vegetation. Well-drained soils have deep water tables, and vegetation must depend on seasonal precipitation for soil moisture. Drought stress in summer reduces accumulation of dark surfaces of humus. In swales and valleys, poorly drained soils have shallow water tables, which form marshes and humus-rich layers. Plants differ in near-infrared reflection properties because of variations in photosynthesis activity, moisture content, and leaf geometry. Actively growing, turgid plants reflect near-infrared light; moisture-deficient or dormant plants do not. Late May photos taken from 10,000 to 20,000 feet above ground in 1969 showed best correlation with ground surveys because of moisture effects on vegetation. Mowing, harvesting, and flood irrigation influenced reflectance. Conventional color photos at high altitudes are of limited value because light is scattered by haze. Infrared is lightly scattered. Figures show typical soil profiles and soil types from infrared and ground surveys. (Popkin - Arizona)
W71-06058

WATER QUALITY TELEMETRY FINAL PROGRESS REPORT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W71-06069

AN INTERFEROMETRIC TECHNIQUE FOR TEMPERATURE AND CONCENTRATION MEASUREMENT FOR AN AIR-WATER INTERFACE,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 05A.
W71-06090

AERIAL PHOTOGRAPHIC TRACING OF PULP MILL EFFLUENT IN MARINE WATERS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-06258

TV INSPECTION AND IN-PLACE GROUTING OF SEWERS,
J. H. White.
Water Wastes Eng, Vol 5, No 9, p 72-74, Sep 1968.

Descriptors: *Inspection, *Cost-benefit analysis, Equipment, Grouting, Sewers.
Identifiers: *Austin, Texas, *Television inspection, Sanitary sewers.

Experiences of Austin, Texas, in using television camera inspection and inplace grouting in sewers are reported. The first experience with television inspection was so successful that lines in question were rehabilitated at a cost less than twenty thousand dollars, instead of two hundred and forty thousand dollars as was considered previously. Television inspection equipment proved to be durable, and down-time was quite low. Television inspection has forced contractors and other utilities to respect sanitary sewers.
W71-06427

7C. Evaluation, Processing and Publication

SUMMARY OF DATA ON TEMPERATURE OF STREAMS IN NORTH CAROLINA, 1943-67,
Geological Survey, Washington, D.C.
Thomas H. Woodard.
For sale by the Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402 - Price $0.75. Geological Survey Water-Supply Paper 1895-A, 1970. 39 p, 1 fig, 1 plate, 2 tab.

Descriptors: *Water temperature, *Streams, *North Carolina, *Hydrologic data, *Data collections, Average, Fluctuation, Standards, Thermal water.
Identifiers: *Stream temperatures, Basic-data compilation.

Stream temperature data collected by the U.S. Geological Survey in cooperation with the State of North Carolina during the period 1943-67 are summarized. Values determined from 850 station years of record from 176 locations throughout the state are shown in two tables. Thirty-one percent of the station years are monthly records, 50 percent are daily, and 19 percent are continuous. Temperature tabulations include average monthly, average annual extremes observed for the period of record at each location, average of monthly maximums, average of daily maximums, average daily, average of daily minimums, and average of monthly minimums. (Woodard-USGS)
W71-05855

WATER RESOURCES OF THE BLACK RIVER BASIN, SOUTHEASTERN MICHIGAN,
Geological Survey, Washington, D.C.
R. L. Knutilla.
For sale by US Geological Survey, Wash, DC, 20242, price $1.75. Geological Survey Hydrologic Investigations Atlas HA-338, 3 sheets, 1970. Text, 6 fig, 7 map, 2 tab.

Descriptors: *Water resources, *Surveys, *Hydrologic data, *Michigan, *Water resources development, Hydrogeology, Streamflow, Duration curves, Profiles, Hydrographs, Data collections, Topography, Geology, Geomorphology, Water supply, Water yield, Water quality.
Identifiers: *Black River Basin (Mich).

This 3-sheet hydrologic atlas is a part of a comprehensive study of the water resources of southeastern Michigan. The purpose of the atlas is to provide information on (1) the physical features of Black River and its tributaries, (2) the characteristics of streamflow, (3) the quality of ground and surface water, and (4) the groundwater aquifers of the area. Water from streams is of the calcium magnesium bicarbonate type and is very hard. Stream water is generally high in sulfates and, locally, high in chlorides. Water from shallow wells in the glacial drift is of the calcium magnesium bicarbonate type. Water from deep wells in the glacial drift is of the calcium magnesium bicarbonate, sodium bicarbonate or sodium chloride types. Water from bedrock wells may be of the calcium magnesium bicarbonate, sodium bicarbonate, sodium chloride, or mixtures of these types. Most wells completed in glacial drift in the southeastern one-third of the basin will yield only small supplies of water, and some will fail to yield even the small amount needed for a domestic supply. Somewhat larger supplies may be obtained from the glacial drift in the north and western parts of the basin. The outwash areas in the headwaters of Mill and Elk Creeks are the most favorable for obtaining large supplies of water. Maps show quality of water, physiography, geology, well yields, and groundwater levels. Stream profiles, hydrographs, tables, duration curves, frequency curves, and tabular presentation are used to summarize data. (Knapp-USGS)
W71-05869

GROUNDWATER RECONNAISSANCE OF THE GREEN RIVER BASIN, SOUTHWESTERN WYOMING,
Geological Survey, Washington, D.C.
George E. Welder.
For sale by U Geological Survey, Washington, DC 20242-price $1.00. Geological Survey Hydrologic Investigations Atlas HA-290, 3 sheets, 1968. Text, 6 fig, 5 map, 2 tab.

Descriptors: *Water resources, *Groundwater, *Maps, *Hydrologic data, *Wyoming, Geologic investigations, Surface waters, Geology, Aquifers, Aquifer characteristics, Water yield, Water quality, Water wells, Water levels, Chemical analysis, Streams, River basins, Springs, Groundwater recharge, Precipitation (Atmospheric), Hydrology, Data collections, Water sources, Seepage.
Identifiers: *Green River Basin (Wyoming), Hydrologic Atlas, Groundwater reconnaissance.

This report, consisting of a Hydrologic Atlas of 5 maps on 2 sheets and a separate text, describes the occurrence and quality of groundwater in the Green River structural basin of Wyoming. Some general information concerning surface water has been included because of the close relationship of groundwater to surface water in parts of the basin. The area consists of approximately 10,000 square miles, which is about 60% of the Wyoming part of the Green River drainage basin. The rocks that underlie the area range in age from Precambrian to Recent. Rocks at the surface are divided as follows: 82% of Tertiary and Quaternary age, 2% of Paleozoic and Mesozoic age, and 16% of Precambrian age. Recharge to groundwater reservoirs is mainly by seepage from precipitation and streams. Yields of most wells range from about 10 to 100 gpm. The quality of groundwater ranges from very poor to excellent with a range of dissolved solids from less than 500 to more than 3,500 ppm. The water in most of the perennial streams contains less than 500 ppm total dissolved solids. Two exceptions are the reaches of Big Sandy Creek below the Eden-Farson irrigation project and Blacks Fork below the Lyman irrigation project. Total dissolved solids in the surface water of these reaches generally exceed 1,500 ppm. (Woodard-USGS)
W71-05902

DISCUSSION OF THE USES OF ELECTRONIC PLOTTING IN GROUNDWATER ENGINEERING,
Johnson and Anderson, Inc., Pontiac, Mich.
G. E. Evans.
Paper, Johnson and Anderson, Inc, Pontiac, Mich, 1970. 19 p, 12 fig.

Descriptors: Computer programming, Engineering, *Computers, Mapping, Boreholes, Calculations, Logging (Recording), Profiles, Electronic equipment, *Civil engineering, Drawings, Abilities, Accuracy, Ideas, *Computer applications, Cost savings.
Identifiers: Computer-aided design, *Plotters, Time saving, Time sharing, Computer capability.

Computer-plotters and their application to civil engineering problems are discussed. Several examples show how laborious plotting and profiling of civil engineering work is speeded up and accuracy increased by using the computer-plotter. Some general statements are made concerning the use of computer-plotter programs for mapping, contouring, borehole logging, planning and profiling, and geologic sectioning. Experience indicates that good engineering programs are more likely to be written

by excellent engineers with reasonable programming skills, than by excellent programmers with engineering skills. (USBR)
W71-05906

STABILITY OF ROCK SLOPES--GRAPHICAL METHODS,
Coyne et Bellier, Paris (France).
For primary bibliographic entry see Field 02E.
W71-05909

SETTLEMENT PROBLEM ORIENTED COMPUTER LANGUAGE,
Illinois Univ., Chicago; and Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 08D.
W71-05915

COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 02F.
W71-05920

A PROGRAMMING MODEL FOR FARM IRRIGATION SYSTEMS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03F.
W71-05923

OPTIMIZATION TECHNIQUES FOR WATER RESOURCE SYSTEMS,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 06A.
W71-06062

SIMULATION OF A WATER RESOURCE SYSTEM, FINAL REPORT,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 05G.
W71-06066

INTERBASIN DIVERSION OF WATER: AN ANNOTATED BIBLIOGRAPHY,
Texas Tech Univ., Lubbock. Water Resources Center.
George A. Whetstone.
Water Resources Center Report WRC-71-1, Vol 2, January 1971. 323 p. Supported by Water, Inc and Texas Tech Water Resources Center.

Descriptors: *Bibliographies, *Inter-basin transfers, *Water resources development, Water supply, Water transfer, Diversion.

Future growth in the state of Texas will depend upon inter-basin water transfers into the state from other regions. This leads to a realization of the need for accumulating all inter-basin transfer literature into a central publication. This volume contains 1027 abstracts in a chronological arrangement (1855-1970) and extends and augments Vol. 1 (abstracted in this publication, W70-06816). The abstracting and indexing formats are identical, with author and geographic indexes. Every effort was made to prevent duplication in subject matter. Papers involving certain large-scale projects were not abstracted unless they contain new information. A third volume is in preparation. (See also W70-06816) (Casey-Arizona)
W71-06071

EXTRAPOLATION OF HISTORICAL STORM DATA FOR ESTIMATING DESIGN-WAVE HEIGHTS,
Chevron Oil Field Research Co., La Habra, Calif.
C. Petrauskas, and P. M. Aagaard.
Society of Petroleum Engineers Journal, Vol 11, No 1, p 23-37, March 1971. 15 p, 17 fig, 4 tab, 9 ref, 2 append

Descriptors: *Waves (Water), *Design storm, *Synthetic hydrology, Offshore platforms, Weather forecasting, Probability.
Identifiers: Wave height forecasting.

An improved method is presented for selecting offshore structure design waves by extrapolating historical storm data to obtain extreme value statistics. The method permits flexibility in choice of distribution functions through use of computerized procedures, estimates extrapolated wave-height uncertainty due to small sample size, and includes criteria for judging whether or not given wave-height values can be represented by one or more of the distributions implemented in the method. The relevance of uncertainty to selection of design-wave heights is discussed and illustrated. (Knapp-USGS)
W71-06123

FLOODS FROM SMALL DRAINAGE AREAS IN CALIFORNIA-A COMPILATION OF PEAK DATA OCTOBER 1958 TO SEPTEMBER 1969,
Geological Survey, Menlo Park, Calif., Water Resources Div.
Arvi O. Waananen.
Geological Survey Data Compilation Report, July 9, 1970. 146 p, 46 fig, 1 tab.

Descriptors: *Floods, *Small watersheds, *California, Data collections, Hydrologic data, Stream gages, Gaging stations, Stage-discharge relations, Surface waters, Discharge measurement, Hydrographs, Rain gages.
Identifiers: Flood data (Calif).

An investigation of the magnitude and frequency of floods from California drainage areas generally of less than about 10 square miles was begun by the Geological Survey July 1, 1958. The objective of the program is to obtain sufficient basic hydrologic data to define for such areas the magnitude and frequency of floods on a regional basis for the entire State, and to obtain sufficient flood-hydrograph data, on a statewide basis, for detailed hydrologic study. The report consists of a tabulation of the annual peak stage and discharge, by water years, for each gaging station in the program. The discharge hydrograph and recorded graph of accumulated rainfall for significant peak discharges during the current year are included for stations that are equipped with water-stage recorders. Monthly and annual rainfall totals are given for the recording stations. In addition, discharge hydrographs and precipitation graphs, as well as monthly and annual precipitation, published in previous annual reports, are repeated in this report to provide a complete record. Program activities during the current year and program plans for the following year are summarized briefly. (Woodard-USGS)
W71-06127

WESTERN SNOW CONFERENCE.
For primary bibliographic entry see Field 02C.
W71-06133

USING ALL AVAILABLE HYDROLOGIC DATA,
British Columbia Water Resources Service, Vancouver; and British Columbia Univ., Vancouver. Dept. of Civil Engineering.
W. Obedkoff, and S. O. Russell.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 31-36, 1970. 6 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Data collections, *Data processing, *Runoff forecasting, *Hydrologic data, Snow surveys, Networks, Watersheds (Basins), Meteorological data.
Identifiers: *British Columbia.

An approach to the use of both meteorological and streamflow data was developed and applied in Labrador. In this method, a river basin is divided into a number of squares, physiographic para
ters are determined for each square, meteoro
cal data are correlated with these parameters
from the resulting equation estimates are mad
precipitation, evaporation and runoff for e
square. Accumulated runoff is compared with m
sured runoff. This paper describes an attemp
apply the method to a mountainous area in the
terior of British Columbia to determine the a
variation in runoff and also to extend the met
by using snow course data as well as meteorolog
and stream gage data. The results are promi
and the technique has important implications
data network design. (See also W71-06133)
napp-USGS)
W71-06138

DEVELOPMENT OF SNOW LOAD DESI DATA FOR THE UNITED STATES,
Environmental Data Service, Silver Spring, Md.
For primary bibliographic entry see Field 02C.
W71-06141

AN APPROACH TO SNOW LOAD EVALU TION,
John Webster Brown, Inc., Reno, Nev.
For primary bibliographic entry see Field 02C.
W71-06142

SNOW COURSE WEIGHTING PROCEDURE,
British Columbia Water Resources Service, V
couver. Hydrology Div.
C. H. Coulson.
Proceedings 38th Annual Meeting of West
Snow Conference, April 21-23, 1970, Victo
British Columbia, Canada: Printed by Colora
State Univ, Fort Collins, p 74-81, 1970. 8 p, 5 fig
tab, append.

Descriptors: *Statistical methods, *Regressi
analysis, *Correlation analysis, *Snow surve
*Water equivalent, Variability, Runoff forecasti
Sampling.
Identifiers: Snow course data, Data weighting.

This paper describes the derivation and use o
method of combining interdependent variables i
a single variable for use in multiple regressi
analyses. The method is statistical and not direc
related to any physical parameters. Use of t
method to solve a given problem requires the use
a digital computer with a plotting arm auxilia
The combination of water equivalents at differe
snow courses is emphasized but the method cou
be extended to other independent variables. An e
ample of weighting snow courses for a Columb
River forecast procedure is illustrated. (See al
W71-06133) (Knapp-USGS)
W71-06146

GROUNDWATER RESOURCES OF NELSO COUNTY, NORTHEASTERN NORTH DAKOT
Geological Survey, Washington, D.C.
Joe S. Downey.
For sale by US Geological Survey, Wash, D
20242 - price $1.00. Geological Survey Hydrolog
Investigations Atlas HA-428, 1 sheet, 1970. Text,
fig, 3 map, 1 tab, 3 ref.

Descriptors: *Water resources developmen
*Groundwater, *North Dakota, *Hydrogeolog
Geology, Aquifer characteristics, Water yiel
Water levels, Water wells, Investigations, Wat
quality, Hydrologic data, Data collections, Chem
cal analysis, Water resources, Evaluation, Map
Water level fluctuations, Groundwater movement
Identifiers: *Groundwater resources (Nelso
County, ND), *Hydrologic Atlas.

This investigation is part of a Statewide program
North Dakota to determine the location and exte
of the groundwater reservoirs (aquifers); to evalu
ate the occurrence and movement of groundwat
within these aquifers, including the sources o
recharge and discharge; and to determine th

hemical quality of the groundwater. Nelson County covers an area of approximately 1,000 square iles in northeastern North Dakota and is almost ntirely covered by glacial drift, which may be subivided into two distinct types. The most common ype, till, was mainly deposited by active glaciers, as a low permeability, and will normally yield only nall quantities of groundwater to wells. Glaciofluial deposits, the least common type, were eposited by moving water, are normally quite ermeable, and form the principal aquifers in Nelon County. The glacial till normally yields water ith greater dissolved solids than water produced om wells tapping glaciofluvial deposits. This 1-eet Hydrologic Atlas includes a Groundwater vailability map and 7 related tables and illustraons. (Woodard-USGS)
71-06160

ATER RELATED LAND USE IN THE BEAR IVER DRAINAGE AREA,
tah Water Research Lab., Logan.
ank W. Haws.
eport PR-WG 40-2, Utah Water Research aboratory, April 1969. 119 maps, 69 tab.

escriptors: *Hydrologic data, *Utah, *Maps, Data collections, *Water utilization, Regional alyses.
entifiers: *Water-related land use, *State water ans, *Bear River.

developing a state water plan, an important item consideration is the amount of water depleted om a system by transpiration and evaporation. he many maps of this study classify the different ops, types of natural vegetation, and other waterlated land usages, and define the areas occupied each so that estimates of depletion can be calcuted. A field study in 1966 obtained aerial photoaphs of the area and labeled them, indicating undaries and types of land use. From these the aps were made. Twenty-nine categories of waterlated land use are shown, and each map covers ghteen sections. Each section is also listed in a ta-e, and the number of acres under each kind of nd use is listed. This report covers the Bear River rainage Area of extreme northeastern Utah. Yensen-Arizona)
71-06212

ATER RELATED LAND USE IN THE UTAH AKE DRAINAGE AREA,
tah Water Research Lab., Logan.
. Leon Hyatt, Gaylord V. Skogerboe, and Frank . Haws.
eport PR-WG 40-1, Utah Water Research aboratory, February 1968. 58 tab, 87 maps, 1 fold ap.

escriptors: *Utah, *Hydrologic data, *Maps, Water utilization, *Data collections, Regional alyses.
entifiers: *Water-related land use, *State water ans.

developing a state water plan, an important item consider is the amount of water depleted from a drologic system by beneficial and non-beneficial getation. The maps of this study classify the types vegetation and water-related land use and define e areas of each so that estimates of depletion can calculated. Aerial photographs of the area were beled, indicating boundaries, types of vegetation, d other land use. These were transferred to base aps, along with irrigation systems. Each map vers eighteen sections. Twenty-nine categories of nd use are shown on the maps. Each section is ted separately in a table, and the number of acres der each kind of land use is listed. The land use r each county and hydrologic sub-area is also mmarized. This report covers the Utah Lake rainage Area of north-central Utah. (Yensen-rizona)
71-06213

HYDROLOGIC INVENTORY OF THE UTAH LAKE DRAINAGE AREA,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-06218

HYDROLOGIC INVENTORY OF THE UINTAH STUDY UNIT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-06219

HYDROLOGIC INVENTORY OF THE WEBER RIVER STUDY UNIT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W71-06220

STATISTICAL SUMMARIES OF NEW JERSEY STREAMFLOW RECORDS,
Geological Survey, Trenton, N.J.
S. L. Laskowski.
New Jersey Division of Water Policy and Supply Water Resources Circular 23, 1970. 264 p, 3 fig, 21 ref.

Descriptors: *Streamflow, *Hydrologic data, *Data collections, *Gaging stations, *New Jersey, Discharge measurement, Surface waters, Flow rates, Low flow, Average flow, Peak discharge, Statistical methods, Duration curves.
Identifiers: Annual flow.

The records for 79 of approximately 110 streamgaging stations presently or previously operated in New Jersey, plus records for three stations in Pennsylvania, and one in New York are presented in summarized form. A description of the station, three arrangements of data summarizing the daily flow records and one table listing statistics of the monthly mean flows are provided. Plotting positions for the three types of curves describing the characteristics of daily discharge are listed for each station. Statistical parameters are also presented so that alternate curves may be drawn. All stations have 5 or more years of record. The data are based on observed flow past the gaging station. For any station where the observed flow is affected by regulation or diversion, a remarks paragraph, explaining the possible effect on the data, is included in the station description. (Woodard-USGS)
W71-06228

PROBLEM OF FLOOD-CONTROL IN SMALL BASINS,
G. Lombardo.
Giorn Genio Civile (GIGCAO), Vol 106, No 2-3, p 110-115, Feb-Mar 1968.

Descriptors: *Computer programs, *Flood control, *Data storage and retrieval.
Identifiers: *Rainfall analysis.

The study of possible utilization of a computer for control of floods in small basins, with revised methods and procedures for gathering and elaborating hydrological data is examined. The procedure for rapid calculation of a rainfall graph and for obtaining flow regime from rainfall characteristics in absence of analytical relation of hydrology is explained.
W71-06298

DENSE NETWORK FOR RAPID MEASUREMENT OF RAINFALL RATE,
For primary bibliographic entry see Field 02B.
W71-06410

COMPUTERS IN HONG KONG PUBLIC WORKS,
For primary bibliographic entry see Field 05G.
W71-06423

08. ENGINEERING WORKS

8A. Structures

FIELD INVESTIGATION OF ENVIRONMENTAL EFFECTS OF COOLING TOWERS FOR LARGE STEAM ELECTRIC PLANTS,
Portland General Electric Co., Oreg. Dept. of Engineering Design.
For primary bibliographic entry see Field 05D.
W71-05930

PROBLEMS IN DISPOSAL OF WAST HEAT FROM STEAM-ELECTRIC PLANTS.
Federal Power Commission, Washington, D.C. Bureau of Power.

1969. 53 p, 11 fig, 4 tab, 39 ref.

Descriptors: *Thermal pollution, *Thermal powerplants, *Cooling water, *Cooling towers, *Aquatic environment, Environmental engineering, Fish physiology, Fish farming, Electric power demand, Environmental effects, Water temperature, Thermal power, Discharge, Ohio River.
Identifiers: *Waste heat disposal, Steam-electric plants, Heat disposal.

This report, prepared by the staff of the Bureau of Power, was prepared as part of the Commission's updating of the 1964 National Power Survey. The report explains the problems and conventional means of waste heat disposal from both fossil fueled and nuclear steam-electric plants in the conterminous United States. The methods of waste heat disposal discussed include once-through cooling, wet tower, dry tower, and evaporative pond cooling. The effects of thermal discharges on streams and water uses and water quality standards are discussed. The aesthetics and environmental concerns are mentioned. Estimates of power requirements and cooling water requirements, together with potential sources of cooling water supplies, are discussed. The capacity of the Ohio River to supply required water quantities is analyzed. A summary of completed and current studies of waste heat disposal problems is included together with statements regarding specific research needs. Comparative investment costs of cooling water systems are given. About 492 plants will be required by 1990, of which about 255 would be new sites. The total generating capacity requirements will be about 1 million megawatts. The significance of water temperature as it affects the physiology of fish is discussed. (Poertner)
W71-05931

FACTORS IN WASTE HEAT DISPOSAL ASSOCIATED WITH POWER GENERATION,
Federal Power Commission, Washington, D.C.
Robert M. Jimeson, and George G. Adkins.
Paper No 26a presented at 68th National Meeting of American Inst of Chemical Engrs, Houston, Feb 28-March 4, 1971. American Institute of Chemical Engineers, New York, 1971. 41 p, 8 fig, 4 tab.

Descriptors: *Thermal powerplants, *Cooling towers, *Environmental effects, *Thermal pollution, *Cooling water, Electric power demand, Water temperature, Thermal power, Environmental engineering, Electric power production, Discharge.
Identifiers: *Waste heat disposal, Steam-electric plants, Heat disposal.

Energy requirements from fossil fueled and nuclear steam generating plants, together with associated waste heat, are projected for the year 1980 and 1990. Ecological effects and beneficial uses of waste heat are stated. The trend in thermal standards for natural water bodies is discussed. The characteristics of various cooling methods for disposing of waste heat at steam-electric powerplants are presented along with their cost and effectiveness. The study concludes that the demand for electric power will increase fourfold by 1990. As

any as 140 and possibly as many as 200 new plants will require cooling towers, and from 50 to 130 new plants may require cooling ponds by the year 1990. The cost to the power industry for control of the water environment is estimated to range from $1.3 to $2 billion per year, and the industry must raise an additional 6 to 9 billion dollars in the capital market in the next twenty years to achieve control of thermal pollution. Much research leading to improved environmental controls is yet needed. Also, additional emphasis should be placed on research leading to more efficient power generation, since successful development would have a major impact on reducing environmental degradation. (Poertner)
W71-05932

MASTER PLAN FOR THE DEVELOPMENT OF WATER DISTRIBUTION FACILITIES FOR GENESEE COUNTY, ENGINEERING REPORT.
Consoer, Townsend and Associates, Flint, Mich.

Genesee County Drain Commissioner, Flint, Michigan, 1969. 96 p, 32 fig, 10 tab. Project No P-Mich-3230; US Dept of Housing and Urban Development.

Descriptors: *Water supply, *Water conveyance, *Water distribution, *Planning, *Water resources development, *Municipal water, Cities, Urbanization, Water delivery, Pumping, Demand, Consumptive use, Hydraulic engineering, Michigan.
Identifiers: *Genesee County, *Flint.

The initial or first phase of the Genesee County water supply system, as proposed in this report, would consist of a pumping station, two 4.0 million gallon capacity standpipes constructed along Vassar Road near Potter Road, trunk distribution mains and a 2.0 million gallon capacity elevated tank located near Grand Blanc and Porter Roads. The water for the County system would be obtained through two 18 inch diameter metered connections to an existing 72 inch main at Vassar Road. The water would flow from the metered connections into two 4.0 million gallon standpipes, from which it would be pumped by the Vassar Road pumping station facilities into the proposed supply system. The first phase of construction would cost an estimated $16,800,000. The second phase would consist of a second pumping station with adjacent 20.0 million gallon ground storage reservoir at Oak and Potter Roads together with additional 36 inch diameter transmission mains. The second phase would cost an estimated $12,600,000. The third phase expansion would include a 20.0 mgd capacity pumping station and 10 million gallon capacity reservoir to be constructed near Elms Road and Stanley Road. This pumping station and related distribution system piping would cost an estimated $5,400,000. The construction and project costs for these three phases of the water system are based upon present-day costs and are related to the present Engineering News-Record Construction Cost Index of 1229. The consultants suggest that project construction costs be financed by the various governmental units served in accordance with estimated benefits. (See also W71-05934) (Poertner)
W71-05933

SNOW LOADS FOR THE DESIGN OF ROOFS IN CANADA,
National Research Council of Canada (Ottawa) Div of Building Research.
D A Lutes.
Proceedings 38th Annual Meeting of Western Snow Conference, April 21-23, 1970, Victoria, British Columbia, Canada: Printed by Colorado State Univ, Fort Collins, p 61-67, 1970. 7 p, 5 fig, 6 ref

Descriptors: *Snowpacks, *Density, *Loads (Forces), Ice loads, Load distribution, Weight, Design, Design criteria, Building codes, Snow surveys, Data collections, Sampling, Topography, Altitude.
Identifiers: *Snow loads, *Canada

A more rational approach to snow loads for the design of roofs in the National Building Code of Canada has resulted from a ten-year country-wide survey of actual snow loads on roofs. The objective of the survey was twofold: to determine by how much average roof loads can be reduced below the level of ground loads; and to assess factors that result in the accumulation of higher loads on particular areas of various shapes of roofs from the effects of wind, sliding, etc. This paper describes the factors that affect snow loads, the survey and its results, and the present requirements for snow loads for the design of roofs in Canada. (See also W71-06133) (Knapp-USGS)
W71-06143

CONTROL OF INFILTRATION IN SEWER SYSTEMS-DESIGN AND MAINTENANCE,
Nashville Metropolitan Government and Davidson County, Tenn. Sewerage Services.
For primary bibliographic entry see Field 05D
W71-06197

INSTALLATION OF SOIL, WASTE AND DRAINAGE PIPING IN FILL OR UNSTABLE SOIL,
T. Cecil Brown.
Water Sewage Works -- Reference Number, p R-47 to R-50, Nov. 28, 1969.

Descriptors: *Installation, *Sewers, *Drainage engineering, *Costs, Subsurface runoff, Infiltration.

Drainage lines, which can be sanitary, storm or combined sewers, should be well designed and constructed, properly supervised during construction, and closely inspected. Recommendations are made in this article to facilitate compliance with these objectives. Sewer installation is described in terms of considerations to be made regarding the filled area. Cost criteria are also discussed. Economy is not always limited to the selection of the least expensive materials because cheaper material may prove to be the most expensive to the taxpayer in the long run. Infiltration and joint failure are treated briefly with recommendations for tight joints and for the prevention of stormwater entrance into sanitary sewers.
W71-06285

A GUIDE FOR CONTRACTORS ON THE CONSTRUCTION OF DRAINAGE SYSTEMS,
A. Dreschsel.
Ber Abwassertech Ver (BABVAD), No 17, p 123-131, 1964.

Descriptors: *Hydrogeology, *Drainage patterns (Geologic), *Drainage engineering.
Identifiers: *Drain pipes, Storm sewers.

The author stresses the importance of preliminary hydrogeological investigations and studies on flow conditions of the area where a drainage system is to be installed. He then deals with the design, construction, materials, and equipment which should be used where drain pipes are required for ordinary drainage systems and/or storm-sewage systems.
W71-06288

ANGLESEY ALUMINUM SEA OUTFALL,
Bruce Dubleton.
Surveyor, Vol 85, No 4049, p 22-25, Jan 16, 1970. 5 fig.

Descriptors: *Outlets, *Methodology, *Aluminum, *Construction materials, *Construction.
Identifiers: *Great Britain.

Decisions and procedures involved in constructing an aluminum sea outfall extension are reviewed. Methods employed for determining the following factors are discussed: length of the extension, material selection, the method of support, construction and launching procedures. Although extension of the outfall presented many constructional problems, its costs was less than for an alternate scheme involving sewage treatment. A nificant feature of the construction proces that work took place from a ten-man infla craft with heavy materials towed into position buoyancy tanks.
W71-06289

LOW-PRESSURE AIR TESTS FOR SE LINES,
W. J. Malcolm.
Am City, Vol 84, No 11, p 74-75, Nov 1969. 2

Descriptors: *Testing, *Sewers, *Infiltra Leakage.
Identifiers: *Sewer lines, *Air-testing.

New waste water lines can be tested for leaka exfiltration either by the common method of pressure or by low-pressure air, a method be ing more popular. Such testing is imperative si there is no exfiltration, neither will there be inf tion. A tight sewer line lowers the volume flo into lines and treatment plants, thus, pumping treatment costs are lowered, and less floodin curs. The author presents eight frequently-a questions concerning air testing, and he ans the questions briefly.
W71-06299

FLOOD CONTROL DESIGN UTILIZES LA ELLIPTICAL PIPE,
Alfred R. Pagan.
Public Works, Vol 100, No 12, p 87-88, Dec 19

Descriptors: *Pipes, Installation, Design, Overf New Jersey.
Identifiers: *Elliptical pipes.

The use of 72- by 113-inch elliptical reinfo concrete pipes in checking overflows in W bridge, New Jersey is discussed. A number of cial fittings were designed which included ac structures, connections, and horizontal storm d deflection sections. Cylinder tests and installa difficulties are mentioned.
W71-06302

WASHED-OUT PLATE CULVERT RESET 17-TON SECTIONS BY CRANE.

Construct Methods Equip, Vol 50, No 7, p 54 Jul 1968. 6 fig.

Descriptors: *Flood damage, *Culverts, *Cra *Repairing, *Construction, *Installation.

When a 500-foot length of culvert comprise 600 plate sections was washed out by a flash flo the contractor unbolted the conduit in 36-foot rels instead of dismantling the pipe plate by p and lifted the sections out by crane. The secti were stored on the bank to be reset after the dried and was restored. A simple wooden scree shaped the concrete sand bed for the 21-(diameter culvert. Details of the construction installation procedures are included.
W71-06336

WORK STARTS ON 11-MILE INTERCEPT TO SOLVE TORONTO'S SEWER PROBLEM.
Eng Contract Record, Vol 83, No 6, p 68-69, 1970. 2 diag.

Descriptors: *Construction, *Contracts, *Interc tion, *Design, *Sewers.
Identifiers: *Canada, *Interceptor sewer, Toron

In metropolitan Toronto an interceptor to reli existing high- and low-level interceptor sewe which are inadequate for the area they cover under construction. S. McNally and Sons Ltd. w among a number of bidders, and it was awarded portions of the project. The project entails the c struction of a 61,640 foot-long shaft varying diameter from 60 to 120 inches spanning the c

om east to west. The estimated time of construc-
on is three years. Information on the operation
id techniques used is included.
71-06337

TORMWATER SEWER DESIGN IN METRIC.

st Munic Engrs, Vol 97, No 5, supplement no 4,
ay 1970.

escriptors: Measurement, *Design.
entifiers: Metric system, Conversions charts,
Storm sewers.

rst impressions of the use of metric units in
ormwater sewer design are expressed. In using the
etric system, awkward multipliers are removed.
nversion charts are listed.
71-06342

ESIGN EXAMPLES IN METRIC.

nst Munic Engrs, Vol 97, No 2, supplement no
, Feb 1970.

escriptors: Measurement, Design.
entifiers: *Combined sewers, Metric system.

metric example of the combined sewer and small
mping station is worked out using the rational
rmula and the Ministry of Health figures for in-
sities of rainfall.
71-06343

EMOTE-CONTROL 'MINI-DAMS' GUARD NNEAPOLIS SEWERS.

nic Eng, London, Vol 146, p 358, 1969.

scriptors: *Construction materials, Overflow,
tlets, Water pollution control, Mississippi River.
ntifiers: *Minneapolis-St. Paul, Rubber storage
ntainers, Storm sewage.

description is given of the installation of inflata-
bags of rubberized fabric at the outlet points of
storm-sewage overflows serving Minneapolis
d St. Paul, Minn. The bags, which were installed
reduce pollution of the Mississippi River during
rms, can be inflated by remote control to pro-
e dams varying in height, thereby at any time
erting as much storm sewage into the intercep-
sewers as the treatment works can accept.
1-06345

AND CITY SOLVES TOUGH SEWERAGE OBLEM.

blic Works, Vol 101, No 2, p 95, Feb 1970.

scriptors: *Sewers, *Steel pipes, *Design, Con-
ction costs, Construction equipment, Infiltra-
.
ntifiers: *Galveston, Texas, *Truss pipe.

using Armco Steel Corporation's double-walled
ss pipe, a groundwater infiltration problem was
minated from Galveston's sewer system. The
ss pipe can also be easily tapped for house con-
tions, and its low infiltration specifications
ke possible an economical design for factory-
t treatment plants. Construction costs for such
nts are included, as well as dimensions of the
a-strength piping.
1-06346

NSTRUCTION COST REQUIREMENTS FOR TER AND WASTE WATER FACILITIES.
primary bibliographic entry see Field 05D.
1-06347

INTERNATIONAL BUILDING EXHIBITION - OLYMPIA LONDON 13-25 NOVEMBER 1969.

Surveyor, Vol 84, No 4039, p 54, 74, 77, Nov 7, 1969. 3 fig.

Descriptors: *Plastic pipes, *Rain gages, *Design criteria, *Construction materials, *Underground structures, Flow rates, Drainage systems, Equipment, Plastics.
Identifiers: *Great Britain.

This article reviews exhibitions of products, equipment, materials, and techniques at the International Building Exhibition at Olympia, London. A new square-line instead of round rainwater gutter system of plastic was displayed, in addition to a squareflow rainwater gage. Both have greater flow capacity than their traditional counterparts. A new drainage system exhibited has the following features: simplicity of layout and specification, push jointing of pipes, fittings, and plumbing connections, and fast laying speed. A domestic underground stormwater drain using plastic Polydrain PVC pipe was demonstrated; this material is now being employed extensively for underground drainage systems.
W71-06348

SUSPENDED SEWAGE PIPELINE.

Water Waste Treat, Vol 12, No 8, p 256, Jul/Aug 1969.

Descriptors: *Construction equipment, *Installation, *Pipelines.
Identifiers: *Great Britain, *Suspended pipeline.

By the use of Hepworth-Polva pvc pipe with flexible couplings, a 12-inch diameter sewage pumping main has been suspended from a bridge (which crosses the River Tay) on fabricated metal brackets which allow for pipe movement arising from thermal expansion and contraction of the pipeline. The method of suspension allows for leveling, and the completed pipeline has an insulating wrapping. The installation also has advantages over traditional materials in that the pipeline is light in weight, immune to corrosion, and requires no maintenance.
W71-06356

STORM OVERFLOWS AND STORM SEWAGE,
For primary bibliographic entry see Field 05G.
W71-06367

DRAINAGE OF WIDE ROAD PAVEMENTS,
K. W. Dobinson.
Inst Engrs (Australia), Vol CE 10, No 1, p 1-6, Apr 1968.

Descriptors: Surface drainage, Design, Drainage engineering, Drainage systems.

The effectiveness of various types of pavement drainage structures is discussed. The surface drainage design method, used under certain conditions, is described. A graphic system for the design of pavement drainage is examined.
W71-06368

MORE THAN JUST A BUILDING,
L. C. Dubs.
Am City, Vol 85, No 6, p 119-124, June 1970.

Descriptors: *Drainage systems, Construction, Overflow, Ohio.
Identifiers: *Dry wells.

A three-phase program designed to place all the city's service functions in one area is underway in Canton, Ohio. The first phase involves the construction of two buildings; one a motor vehicle service center, and the other a street and sewer department. The service center's unusual drainage system consists of a system of dry wells constructed throughout the area with one large dry well absorbing overflow from the smaller ones. This system was adopted because storm sewers were not available in the region. Only minor flooding occurred once when there was a heavy rainfall, so the effectiveness of this system was evidenced.
W71-06369

A NEW TWIST (90 DEGREES IN FACT) TO SEGMENTED SEWER - PIPE DESIGN.

Eng Contract Record, Vol 83, No 6, p 56-57, Jun 1970.

Descriptors: *Sewers, *Design, *Estimated costs, Installation.
Identifiers: *Canada, *Sewer hydraulics.

The City of Edmonton, Canada, is using a new segmented pipe on the sewer line in the downtown area. Chief design engineer F. Bereczky thought of tilting a horizontal sewer line to a 90 degree position, thus changing the flow characteristics. The design of the pipe has been worked out so that all dimensions are a function of the inside diameter, and the design can be adopted to any size of pipe. The installation procedure and the estimated cost of the new line are given.
W71-06376

WATER STORAGE METHODS -- FROM CUPPED HANDS TO COMPUTERS,
T. W. Lumsden.
Water Pollution Control, Vol 107, No 6, p 16-19, and 30, Jun 1969.

Descriptors: *Reservoir storage, Construction costs, Storm drains, Storm runoff.
Identifiers: *Stormwater systems.

Storage tanks and reservoirs should provide for flow equalizing, fire protection, and emergencies. An overall system analysis is usually necessary to determine the most economical combination of storage facility, trunk mains, and pumping facility. Criteria for locations of storage facilities and construction cost considerations are noted in this article. Stormwater systems exhaust sizable segments of expenditures utilized for water storage in general. Drains must provide for normal stormwater runoff and higher flows resulting from reservoir emptying and inadvertent overflows.
W71-06385

SOLUTION OF AN UNUSUAL SUBSURFACE DRAINAGE PROBLEM,
E. W. Brand.
J Irrigation Drainage Div, Am Soc Civil Engrs, Vol 94, No IR2, p 199-221, Jun 1968.

Descriptors: *Subsurface drains, *Surface-groundwater relationships, Design, Storm runoff.
Identifiers: *Surface runoff, Groundwater, Belgium.

The stages followed in designing a subsurface drainage system for the inner-ring road being built in Antwerp, Belgium are described. The system will collect and carry away surface runoff, will permanently lower the groundwater table, and will collect and carry away seepage water resulting from this lowering. Conventional methods were adopted for stormwater drainage design. The seepage water and stormwater collected in a catch basin will run by gravity in pipes to one of four low points in the road's vertical profile. From two of these points the water will flow to pumping stations and from the other two, into rivers. The most complicating factor in the subsurface drainage design was the possible effect of the precipitation of ferric oxide from groundwater. This factor necessitated complete submergence of the intake system. Factors influencing the final selection of the subsurface drainage system are explored in detail.
W71-06392

STUDIES ON THE CHEMICAL CONTROL OF TREE ROOTS IN SEWER LINES,
For primary bibliographic entry see Field 04A.
W71-06397

INFILTRATION IN SEWERS,
W. J. Robertson, and A. W. Bird.
Australian Civil Eng, Vol 10, No 4, p 44-47, Apr 1969.

Descriptors: *Investigations, *Infiltration, Sewers.
Identifiers: *Australia.

Extensive investigations carried out by the Melbourne and the Metropolitan Board of Works, where the problem of entry of extraneous water into the sewerage system was studied, is discussed. Factors affecting wet weather infiltration are enumerated.
W71-06403

SOME THOUGHTS ON SEWER PIPE BEDDING,
William J. Warwick.
Water Pollution Control, Vol 107, No 8, p 30-31, Aug 1969.

Descriptors: *Pipelines, Design criteria, Installation.
Identifiers: *Sewer pipe bedding.

Important aspects of sewer pipe bedding are explored in the areas of: satisfactory bedding needs, economics of installation, special cases, enforcement of design criteria, and performance. Technical information is lacking concerning the special case of common or separate trenches for side-by-side storm and sanitary sewers or sewer connections. Usually two such pipes are laid in a common trench, but the economics and functional usages may not always warrant this choice. More study is needed to determine the advantages or disadvantages of dual trenches.
W71-06412

NEW IDEAS FOR CALCULATING STORM WATER OVERFLOW SETTINGS AND THE DESIGN OF STORM WATER TANKS.

Civil Eng Public Works Rev, Vol 65, No 766, p 487, May 1970.

Descriptors: *Storm runoff, *Overflow, *Design.
Identifiers: *Storm overflows, Storm tank.

The Technical Committee on Storm Overflows devised a new formula for setting storm overflows which enables them to be designed without first conducting infiltration surveys. The report of this committee also condemns the use of low-side weir storm overflows because they cause excessive pollution. Ideas for the use of storm tanks during periods when they are not required for their design purposes are proposed. The question of flow standard storm tank effluent discharged at the same time as high-quality standard effluent is presented but not answered in this report.
W71-06416

STORM OVERFLOWS AND THE DISPOSAL OF STORM SEWAGE.

Effluent Water Treat, Vol 10, No 3, p 154-155, Mar 1970.

Descriptors. *Storm runoff, *Sewage, Design, Screens, Overflow.
Identifiers Storm tank, Storm sewage, Great Britain

Comments on the final report of the technical committee concerned with storm overflows and the disposal of storm sewage, are discussed. It is the first known official document containing recommendations on the settling of storm overflows and on the bases of storm tank design. The main conclusions and recommendations of this British report are listed.
W71-06417

MAIN DRAINAGE,
T. A. Anderson.
Surveyor, Vol 83, No 4010, p 92-94, Apr 18, 1969. 6 fig.

Descriptors: *Sewers, *Construction, Tunneling, Geomorphology, Installation, Legal aspects.
Identifiers: *Construction problems, *Sewer construction, *Scotland.

The author describes several sewer jobs he undertook as a Resident Engineer in the Glasgow Office of Public Works. One job entailed the construction of a two-mile main duplicate sewer in Rutherglen. Problems arising due to encounters with varying types of ground are related and measures taken explained. As a result of high pressure, escapes of air (blow-outs) occurred on a nearby railway line. Tunneling was halted until a tunnel shield was installed which helped complete the job. Other construction problems relating to sewer jobs are discussed. Interference with Glasgow parking areas due to sewer construction was solved through the institution of a program of conversion of open spaces to off-street car parks. In conclusion, the author recommends the establishment of regional sewerage authorities similar in organization to Scotland's Water Board, plus the formation of drainage boundaries on a topographical rather than a parochial basis.
W71-06422

8B. Hydraulics

FLAT-VEE WEIRS IN ALLUVIAL CHANNELS,
Hydraulics Research Station, Wallingford (England).
William Rodney White.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY3, Paper 7989, p 395-408, March 1971. 14 p, 11 fig, 2 ref.

Descriptors: *Weirs, *Alluvial channels, *Channel morphology, *Stage-discharge relations, *Hydraulic models, Model studies, Sediment transport, Hydraulic similitude, Sedimentary structures, Bed load, Alluvium, Gaging stations, Stream gages.
Identifiers: Flat-vee weirs.

Sediment tests were carried out with the ultimate aim of providing design data for flat-vee weir installations in alluvial channels. The model study was of an idealized nature but did serve to indicate those variables which are important and the type of conditions where shoaling in the approach channel is likely to occur. Correlation with initial movement theory was established and the results were used to predict prototype bed formations in terms of sediment properties and flow conditions. The mean angle at which the water surface line contracted was one on three. The breadth of channel between the side shoals immediately upstream of the weir crest line was, in each case, 1.1 m while the water surface breadth at the crest was approximately 1.0 m. This means that near the crest line the shoals extended into the river almost to the point where water was just spilling over the crest line. (Knapp-USGS)
W71-05849

EFFICIENCY OF HYDRAULIC JUMP,
Uttar Pradesh Irrigation Research Inst., Roorkee (India).
Satya P. Garg, and Hari R. Sharma.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY3, Paper 7994, p 409-420, March 1971. 12 p, 6 fig, 3 tab, 11 ref.

Descriptors: *Hydraulic jump, *Stilling basins, *Energy dissipation, Head loss, Hydraulic structures, Flow, Open channel flow, Hydraulics, Critical flow, Drops (Structures), Froude number.
Identifiers: Efficiency (Hydraulic jump).

The existing definitions of the efficiency of hydr lic jump may not furnish a correct picture of physical phenomenon. A more rational definit of the efficiency of hydraulic jump on a horizo floor in a rectangular channel is given by the r of the energy actually dissipated in the jump to required to be dissipated. The jump efficiency creases rapidly with increasing Froude number it becomes asymptotic to the 100% line at a Fro number of about 4. The scouring energy of the f downstream of the jump also decreases with creasing Froude number. Experimental data h been presented which show that scour be hydraulic structures provided with jump-t stilling basins in which the Froude number of incoming flow is less than 4.5 can be reduced c siderably by the provision of floor blocks. (Kna USGS)
W71-05850

ON UNIFORM FLOW THROUGH SMOO RECTANGULAR OPEN CHANNELS,
Connecticut Univ., Storrs. Dept. of Agricult Engineering.
N. Narayana Pillai.
Text also in French. Journal of Hydra Research, Vol 8, No 4, p 403-418, 1970. 16 p, 4 1 tab, 16 ref.

Descriptors: *Open channel flow, *Chan morphology, *Pipe flow, *Closed conduit fl Uniform flow, Steady flow, Hydraulic gradi Roughness (Hydraulic), Hydraulics, Flum Canals.
Identifiers: Karman-Prandtl equation.

The deviation of experimental data on smo rectangular channels from the smooth pipe gram, (Karman-Prandtl equation) which is of recommended for use with an equivalent p diameter of 4R, is shown to be mainly due to the fect of shape. A function is defined to take car the effect of shape. Hydraulic radius has b shown to be a very useful parameter in open ch nel flow hydraulics. But to reflect the shape eff another linear parameter was required. The wet perimeter was used in this analysis. (Knapp-USG W71-05863

THE GENERATION OF LANGMUIR CIRCU TIONS BY THE EDDY PRESSURE OF SU FACE WAVES,
Maryland Univ., College Park. Inst. for Fl Dynamics and Applied Mathematics; and Ma land Univ., College Park. Graduate Meteorol Program.
For primary bibliographic entry see Field 02H.
W71-05871

DIFFUSION FROM A CONTINUOUS SOUR IN A UNIFORM SHEAR FLOW,
Johns Hopkins Univ., Baltimore, Md. Chesape Bay Inst.
For primary bibliographic entry see Field 05B.
W71-05872

HORIZONTAL TRANSPORT IN A ROTATI BASIN OF PARABOLIC DEPTH PROFILE,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 02E.
W71-05903

WIND-DRIVEN CURRENTS IN A LO ROTATING CHANNEL,
Northwestern Univ., Evanston, Ill. Technologi Inst.
For primary bibliographic entry see Field 02E.
W71-05904

RESONANCE IN PRESSURIZED PIPI SYSTEMS,
International Power and Engineering Consulta Ltd., Vancouver (British Columbia).

1. H. Chaudhry.
roc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No
IY9, p 1819-1839, Sept 1970. 21 p, 12 fig, 1 tab,
2 ref, 2 append.

escriptors: Closed conduits, *Hydraulics, *Fluid
echanics, Valves, Frequency, Matrix algebra,
Pipelines, *Resonance, Pressure head, Orifices,
luctuation, Water hammer, Fourier analysis,
umped storage, Water supply systems, *Water
stribution (Applied), Harmonics, Bibliographies,
oundary conditions.
lentifiers: *Oscillatory fluid flow.

new approach based on the transfer matrix
ethod used in the theory of vibrations is
esented to study steady-oscillatory flows, and to
termine resonating characteristics of pressure
nduits. By linearizing the friction loss term, con-
dering the system as distributed, and assuming
scharge and pressure head fluctuations as
nusoidal, field matrices for simple pipelines and
rallel systems are derived. Point matrices for ori-
es and for oscillating valves having sinusoidal
lve movement are obtained by linearizing the
te equation. Point transfer matrices for branch
stems with the side branch having different boun-
ry conditions are also developed. A procedure is
tlined to determine the resonant frequencies of
stem types commonly used in waterpower
velopment and water supply schemes. Validity of
e method is demonstrated by comparing results
th experimental values and with values obtained
the method of characteristics. (USBR)
71-05905

EPORT ON TRAPEZOIDAL FLUME MODEL.
s Angeles County Flood Control District, Calif.

epared for US Forest Service, Pacific Southwest
rest and Range Experiment Station. March
63. 29 p, 19 fig.

scriptors: *Model studies, *Demonstration
tersheds, *Forest fires, *Debris avalanches,
rface runoff, *Flumes, Canyons, Forest
nagement, Hydraulic models, Hydraulic en-
eering, Froude number, California.
entifiers: *Los Angeles, Trapezoidal flumes.

llowing the San Dimas Canyon (Johnstone
ak) Fire of 1960, the United States Forest Ser-
e established a comprehensive research project
h the Experimental Forest, one phase of which
s to obtain and evaluate hydrologic data relative
runoff and debris movement from burned
tersheds. A preliminary step undertaken in this
ject of the research project was the construction
installation of 36 flumes of trapezoidal section
selected watersheds ranging between 2 and 101
es in size. On the basis of observations made
ing storm runoff periods and analysis of
drologic data obtained during the 1961-1962
rm season, the Forest Service concluded that
draulic model tests of field installations should
undertaken. In view of the value of hydrologic
a from recently burned watersheds, the Los An-
es County Flood Control District joined with the
rest Service in conducting model flume tests.
e report describes the model study and presents
ng curves to relate flow rate and stage recorded
water level recorders. These rating curves are
ended for general application to all flumes where
ocity immediately upstream from the inlet is less
n critical velocity in the flume, and where the
ne, is free from effects from downstream flow
ge, but are considered only indicative where
v contains appreciable debris quantities. In ad-
on, criteria are presented for modification of
ne installations to effect a control at flume inlets
ere such control does not already exist.
ertner).
1-05929

E-DIMENSIONAL OPEN CHANNEL HEAT PERSION,
nessee Univ., Knoxville.
primary bibliographic entry see Field 05G.
1-06085

CANAL CAPACITY STUDIES MAIN CANAL COLUMBIA BASIN PROJECT,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 04A.
W71-06109

TURBULENT DISPERSION IN POROUS MATERIALS AS MODELED BY A MIXING CELL WITH STAGNANT ZONE,
California State Coll., Long Beach; and California Univ., Los Angeles.
For primary bibliographic entry see Field 02F.
W71-06122

EXTRAPOLATION OF HISTORICAL STORM DATA FOR ESTIMATING DESIGN-WAVE HEIGHTS,
Chevron Oil Field Research Co., La Habra, Calif.
For primary bibliographic entry see Field 07C.
W71-06123

PENETRATION IN A GRADED FILTER,
Missouri Univ., Rolla. Dept. of Civil Engineering.
William Chuan Shen.
M. Sc. Thesis, 1970. 91 p, 2 fig, 6 tab, 8 ref, append. OWRR Project A-028-MO (1).

Descriptors: *Filters, *Filtration, *Porous media, Sands, Seepage, Percolation, Hydraulic radius, Porosity, Pores, Interstices, Voids, Deposition (Sediments), Erosion control, Water level fluctuations.
Identifiers: *Filter clogging, *Graded filter beds.

An experimental laboratory study was conducted to examine clogging within and penetration of fines into a single layer graded filter. Hydraulic gradient, filter gradation and flow direction were varied. Forty one tests gave over 600 penetration depths. The magnitude of penetration in filters with considerable variation in gradation patterns correlated with an average hydraulic radius based on the volume of voids and an approximated total surface area. An increased thickness of poorly graded filter will stop penetration such as that caused by seepage erosion. A relationship between hydraulic radius, penetration depth and probability of penetration is presented. (Knapp-USGS)
W71-06151

THE MATTHES ROLLING DIAMETER AS AN INDICATOR OF CHANNEL STABILITY,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02J.
W71-06169

HYDRAULIC OVERLOADING-FACT OR FICTION,
Resource Consultants, Inc., Nashville, Tenn.
For primary bibliographic entry see Field 05D.
W71-06198

SOME FACTORS TO BE CONSIDERED IN THE DESIGN OF WASTE DISPOSAL WELLS,
Geological Survey, Nashville, Tenn., Water Resources Div.
For primary bibliographic entry see Field 05D.
W71-06199

THE MECHANISM OF DIRECT RUNOFF FROM RAINFALL,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W71-06264

THE LE ACOUSTIC FLOWMETER - AN APPLICATION TO DISCHARGE MEASUREMENT,
C. R. Hastings.
J Water Works Assoc, Vol 84, No 2, p 127-151, Jun 1970.

Descriptors: *Flowmeters, *Discharge measurement, *Hydraulics, *Instrumentation, Testing.

A variety of discharge measurement devices have been invented of which a flow measuring system using the LE Flowmeter is the most recent system to substantially advance the art. The concept employed is an application of numerical integration by Gaussian Quadrature. Test results under varying conditions of fully developed and distorted flow show that this measurement system has an rms accuracy better than 1.0 percent. Use of the LE Acoustic Flowmeter give this flow measuring system features not possessed by other devices, such as linearity, bidirectionality, no head loss, and not need for calibration.
W71-06293

CHARACTERIZATION AND CONTROL OF COMBINED SEWER OVERFLOWS, SAN FRANCISCO,
D. W. Eckhoff, A. O. Friedland, and H. F. Ludwig.
Water Res, Vol 3, No 7, p 531-543, 1969.

Descriptors: *Overflow, Outlets, *Analytical techniques, Runoff, Sewage treatment.
Identifiers: *San Francisco, *Storm sewage.

In order to find methods for controlling or treating storm-sewage overflows from combined systems in urban areas, overflows from the combined sewerage system of San Francisco were measured and sampled for analysis at two outfalls in the city. The dry-weather flows were also monitored. From the data obtained and other observations, the annual runoff for the whole of the city was compared with its total annual discharge of treated sewage effluent, and the effects of the dry-weather flow on the overflow and of the overflow on receiving waters were investigated. The latter effect produced a considerable increase in the numbers of coliform bacteria which remained higher than normal for about two weeks. The studies showed that treatment of overflows from combined systems could result in a substantial reduction of pollution at less expense than would be involved in separating the systems, and that dissolved - air flotation with chlorination appeared to be a promising method.
W71-06326

SYMPOSIUM ON STORM SEWAGE OVERFLOWS.
For primary bibliographic entry see Field 05G.
W71-06363

CRITICAL OBSERVATIONS FOR HYDRAULIC MEASUREMENTS OF FIXED STORM-SEWAGE OVERFLOWS,
For primary bibliographic entry see Field 05G.
W71-06372

OVERFLOW STUDIES AT A SEWER SYSTEM OF A METROPOLITAN CITY,
Wilhelm v.d. Emde, and Siegfried Hoffman.
Gas Wasserfach (GAWFAN), Vol 110, No 12, p 321-325, Mar 1969. 4 ref.

Descriptors: *Sewers, *Measurement, *Storm runoff, *Overflow, *Parametric hydrology, *Rainfall, *Mathematical studies.
Identifiers: *Capacity, *Germany.

For determining the capacity of the sewer system including stormwater drainage in Hamburg, the flow speed, the water level, and the sludge deposition during dry weather were measured. The speed is found to be approximately 0.5m/sec, and sludge deposition is hardly avoidable at the low inclination of the canal system. The conditions during rainy weather were determined with automatic level recording units. From these level measurements the frequency of overflow in days/year, the overflow duration in hours/year, and the overflow quantity/year were calculated. From the recordings of rainfall and the level measurements at the overflow

spills of the sewer system a diagram is drawn according to Kuipers' equation providing information on the storage capacity and discharge capacity of the overflow spills. These two parameters determine the critical rainfall for the overflow spill. Its magnitude decreases with increasing duration of rain and asymptotically approaches the discharge capacity. To avoid frequent overflow, calculations should be based on the critical rainfall as a function of the overflow time. Since this is not practical, it is recommended to use the normal rainfall for the calculation and multiply the quantities obtained by a constant factor.
W71-06373

METHOD OF AND MEANS FOR DEALING WITH STORM-WATER OVERFLOWS IN SEWERS AND LIKE DRAINAGE SYSTEMS,
F. Wood.
Brit Patent 1,023,311.

Descriptors: *Overflow, *Drainage systems, *Bays, *Treatment facilities, Sewerage, Screens, Outlets.
Identifiers: *Storm sewage, *Storm overflows.

The equipment examined for dealing with storm-sewage overflows in sewerage and other drainage systems comprises a bay fitted with a trough or channel which has walls of unequal height and a mouth covered with a filter screen, which can be cleaned by a rake or rakes rotating in the direction of flow of water through the bay. Under normal conditions of flow, water passes through the bay directly to the sewer, but under storm conditions, the increased flow causes a build-up of pressure in the bay so that water and floating trash flows over the lower wall of the trough and through the screen to the storm-sewage outlet. Trash is swept from the screen by the rake (s) over the higher wall into a trash pit and thence to the sewer.
W71-06375

NEW REGULATIONS AND CONSTRUCTIONS OF STORM-SEWAGE OVERFLOWS, FOR THE RELIEF OF RECEIVING WATERS,
R. Lautrich.
Ber Abwassertech Ver (BABVAD), Vol 19, p 175-193, 1968.

Descriptors: *Regulated flow, Rainfall-runoff relationships.
Identifiers: *Storm overflows.

This paper deals with the relation between the critical rainfall and runoff and the resulting dilution. Investigating the effect of the fundamental lay-out of storm sewage overflows, the author concludes that if two storm sewage overflows are constructed at a given position in place of one, the polluting load discharged to the receiving water can be greatly reduced.
W71-06382

PORTABLE RECORDING OF SEWER FLOW.

Water Wastes Eng, Vol 6, No 12, p 12, Dec 1969.

Descriptors: *Storm runoff, *Manholes, Sewerage, Hydrology.
Identifiers: *Sewer hydraulics, Sanitary sewers, Surface flow, Toronto.

In the region including Toronto, sewer flows were measured in order to assess problems arising from storm flows and infiltration into sanitary sewers. It was found that poor manhole hydraulics in one or two manholes can reduce capacities of large sewer systems. Continued observation and control of methods by which surface water enters sanitary sewers was recommended.
W71-06390

DESIGN OF SUB-SURFACE DRAINAGE SYSTEM FOR INNER RING ROAD OF CITY OF ANTWERP,
F. W. Brand.
Roads Road Construct, Vol 46, No 546 and 547, p 162-168, Jun 1968, and p 201-207, Jul 1968.

Descriptors: Pump testing, Evaluation, Seepage, Electrical studies, Pipe flow.
Identifiers: *Belgium.

The procedure adopted for the design of a permanent dewatering system for the depressed inner ring road in the City of Antwerp, Belgium is presented. Details are given related to the execution and analysis of extensive field pumping tests; the calculation of seepage quantities; and the study of hydraulics of horizontal intake pipes adopted to effect groundwater lowering. A number of electrical model tests that map flow nets for a number of vaules of parameters determining critical pipe elevations are examined.
W71-06391

RATIONAL 'RATIONAL' METHOD OF STORM DRAINAGE DESIGN.

J Irrigation Drainage Div, Am Soc Civil Engrs, Vol 95, No IR4, p 634-637, Dec 1969.

Descriptors: *Design storm, Time series analysis, Rational formula.
Identifiers: *Sewer hydraulics.

The value of using the rate-duration-frequency curve as the design storm pattern is discussed in reference to intensify-time rainfall charts compiled in Cleveland, Ohio. In complete computation in the Rational Method is due to the omission of time needed for flow traveling through the sewers.
W71-06393

VELOCITY MEASUREMENTS IN SEWERS VITAL TO DESIGN AND MAINTENANCE,
Lamont W. Curtis.
Water Sewage Works, Vol 116, No 4, p 144-147, Apr 1969. 2 diag, 2 tab, 2 graphs, 1 ref.

Descriptors: *Flow measurement, *Sewers, *Analysis, *Methodology, *Velocity, Mannings equation.
Identifiers: *Sewer hydraulics.

Discharges can be converted to waste water volumes per capita in a sanitary sewer, or can be related to rainfall in a storm sewer. The velocity, depth, and slopes measured can be used to compute Manning's coeficient of the roughness-friction factor. The salt-concentration method of measuring velocity was best suited for developing a discharge-depth relationship for a number of sewers, as well as giving an indication of the condition of the sewer. The equation applicable for the salt-concentration method is Q — AV, where: Q is the discharge; A is the area, computed from the measurement of the flow depth; and, V is the velocity measurement. The equipment needed, procedure, analyses of data, and continuous gaging methods are discussed in detail. It is concluded that there is no ratio, which when applied to surface velocity measurements, will give accurate average velocities in a pipe. Results of the studies indicate, however, that a ratio of .75 will give a good approximation for flow depths between .2 and .4 of the pipe diameter.
W71-06394

DETERMINATION OF FLOOD FLOWS AND DISCHARGE COEFFICIENTS IN MUNICIPAL SEWERAGE SYSTEMS,
T. Dimchev.
Vodosnab Sanit Tekh, Vol 3, p 115-132, 1966, p 115-132, 1966.

Descriptors: *Discharge coefficients, Sewers.
Identifiers: *Bulgaria.

Studies have continued on the discharge properties of sewerage systems in Bulgaria, and results are given for catchment areas in Sofia, Varna, and Burgas. From these data a new formula was developed for calculating the overall discharge coeffi
a particular area. The effect of the free v
the sewerage system on the quality of the d
was also considered.
W71-06395

**PRACTICAL HYDRAULICS FOR
WORKS ENGINEER,**
F. E. McJunkin, and P. A. Vesilind.
Public Works, Vol 99, No 9, 10 and 11,
Sep 1968, p 114-120, Oct 1969, p 77-
1968.

Descriptors: *Hydraulic engineering, Multi
pose projects, Flow, Flow measurements, P
Identifiers: *Sewer hydraulics.

This article is a review of methods of applic
hydraulic engineering principles and proce
meet the needs of engineers involved in h
work of design and analysis of public wo
jects. The conveyance of water by means o
closed conduits, flow in open conduits, an
mentals of flow measurement are explor
hydraulics of pumps are investigated.
W71-06398

**DEPTH OF FLOW AS DESIGN CRIT
FOR CHANNELS WITH ARTIFICIAL LI**
J. C. McWhorter, T. G. Carpenter, and R. M
Nat Acad Sciences -- Nat Research Co
Highway Research Rec, No 261, p 18-24, 1

Descriptors: *Design criteria, *Drainage
*Erosion control, *Channels, *Linings, Tes

A study of water disposal systems which d
noff is presented. Six artificial liners w
vestigated to develop design criteria for
channels. Liners installed on flat-bottor
channels (2 ft wide, 60 ft long) and on slop
subjected to increasing flows to channel
Test sections of sand to heavy clay were ins
the channel floor, and the effectiveness of t
was observed. Measurements consist of flo
channel and water surface profiles, and test
erosion.
W71-06399

**INCREASING SEWAGE FLOW VELOC
USING CHEMICAL ADDITIVES,**
J. L. Overfield, J. K. Baxter, H. R. Crawford
W. Santry.
Paper presented at Water Pollution Contr
41st Annual Conference, Sep 22-27, 1968.

Descriptors: *Sewers, *Flow rates, *Cost
*Flow characteristics, *Additives.
Identifiers: *Sewer hydraulics, *Chemic
tives.

It is possible today to increase the flow of se
an existing sewer without increasing the flu
This increase can be made by the addition
tive chemicals. The flow in an overflowin
may be increased to the extent that sewa
not back up in the sewer manhole and o
into streams and house basements. By usi
chemicals, it is possible for a community to
sewer lines of their periodic peak loads
resorting to expensive relief sewers. Data m
during an extensive test program show th
can be increased approximately 2.5 times
flow. Measurements were made on a test
utilizing six-inch sew pipe (plus auxiliary
ment required to operate the test
Biochemical tests were conducted on
sewage bacteria, fish, and algae to determ
verse effects of chemical additives to sewe
receiving streams. No significant adverse
were found. A cost/effectiveness analysis
that, for a sample case, it cost less than one
much to use chemicals to relieve an over
sewer than to put in a relief line. Develop
improved flow characteristics was based up
performed by The Western Company, in im
its oil field servicing activities.

71-06400

YDRAULIC DESIGN OF SELF-CLEANING CWAGE TUNNELS,
S. Paintal.
n Soc Civil Engrs, Vol 95, No SA6, p 1182-1184, ec 1969.

escriptors: *Hydraulic design, Sewers, Bed loads. entifiers: *Sewer hydraulics, *Capacity, *Sewage nnels.

e author contends that: (1) the main conern in design of sewage tunnels is the transportation of oming grit and sewage material; (2) the trans-rting capacity of water is important because of bearing upon the possible clogging of sewers; the minimum traction assumed in the design of ver tunnels must be adequate to keep it roughly flushed; and (4) the application of ex-ng bed load formulas to fixed bed channels is not irable.
1-06401

RBULENT FRICTION IN ECCENTRIC AN-LAR CONDUITS,
es M. Robertson.
CE Combined Sewer Separation Project, Univ llinois, T and AM Report No 310, Mar 1968. 13 3 tab, 48 ref. FWPCA Program No 11020 EKO.

criptors: *Flow around objects, *Head loss, essure conduits, Data collections, Flow rates. ntifiers: *Annular pipes, *Hangers, Eccentrici-Sew-in-sewers.

owing a general review of the analytical and ex-mental information on the friction loss encoun-d by fluids flowing in annular pipes, with par-lar regard to the influence of eccentricity of the r member, experiments are described on an uation of the friction of water in a steel annular of diameter ratios 5.8 and 3.2 in the Reynolds ber range of ten to the fifth power to ten to the power. It is found that on a discharge basis, he same head loss in a given length, with the eter ratio of 5.8 the flow capacity of the pipe is decreased 12.7% in the concentric situation only 4.5% with full eccentricity. The latter ease is not greatly different from the 3% reduc-in area due to the inserted smaller pipe. An ysis is included showing that for the simple in-at full eccentricity the near-full-flow capacity sewer is little affected. The effects of hangers as might be employed to support inserts in rs is found to have an appreciable effect on the capacity of a full-flowing sewer.
-06402

ERIMENTAL ESTIMATION OF DETEN-N IN STORM SEWER SYSTEM,
eishi, and A. Katsuya.
s Japan Soc Civ Engrs, Vol 151, p 47-57, Mar .

riptors: *Storm runoff, *Capacity, Sewer ulics.
ifiers: *Storm sewers, *Capacity, Sewer ulics.

lts of an experimental study on storm runoff in ban area showed that the phenomena called as detention, retardation, storage and flooding hydraulically identical phenomena. These ex-ents were made for sewer slopes of 1/200 and 0. The control structures had negative effects e capacity of dynamic storage except when ng in the lower area was concerned or when rainage pump capacity was designed to be ssed. Flooding does not always occur by in-ng the return period, because the maximum f runoff becomes a steady state when calcu-by the rational method.
06404

LONG-TIME DRAINAGE PROBLEM IS ELIMINATED,
Alfred R. Pagan.
Public Works, Vol 100, No 6, p 98-99, Jun 1969.

Descriptors: *Drainage engineering, Design storm, Hydraulics, New Jersey.
Identifiers: *Pipelines.

The manner in which Demarest, New Jersey solved its drainage problem is discussed. The pipe line has a flow velocity during the design storm of less than 9 feet per second. Calculations indicate that the pipe provides an additional margin of capacity for even greater storms. Costs, contractors, and unforeseen complications are discussed.
W71-06405

DEVELOPMENTS IN SEWER MONITORING EQUIPMENT AND TECHNIQUES,
R. Galliers, and M. V. King.
J. Inst Munic Engrs, Vol 97, p 27-31, Jan 1970.

Descriptors: *Instrumentation, *Storm runoff, Sewers.
Identifiers: Sewer hydraulics, Birmingham, Alabama.

This paper describes equipment and techniques developed over the last five years by the City of Birmingham Public Works Department concerning flow in sewers. These methods can be applied to the control of trade effluent discharge, the design of sewers and river channels, and to the solution of drainage problems brought on by sewer flows such as storm overflows on rivers. Automatic equipment only was used to study storm flows since waiting for storm is not feasible. Automatic depth recording of rivers will soon be undertaken to obtain unit hydrographs for intense storms. This is the best method of designing natural catchments. Included are labeled diagrams of equipment used such as the streamline pressure head and recorder for depths of flow and various sampling machines used for qualitative tests on samples taken at known times.
W71-06428

8C. Hydraulic Machinery

TRANSMISSION IN THE 70'S,
Westinghouse Electric Corp., East Pittsburgh, Pa.
R. F. Lawrence.
Westinghouse Eng, Vol 30, No 6, p 180-184, Nov 1970. 5 p, 11 fig, 2 tab, 2 ref.

Descriptors: *Transmission (Electrical), Transmission lines, *Power interchange, Power loads, *Ultra high voltage, Right-of-way, Planning, *Extra high voltage, Reliability, *Interconnected systems, Power system operations, Power system stability, Forecasting, Direct current, Decision making, Underground transmission lines.
Identifiers: Transmission capacity.

Decisions made in the 1970's about kinds and voltage levels of power transmission will establish the patterns for several decades. Surveys and industry reports show no plans for transmission voltage levels above 765 kv. Installation of larger-size generating units will require more and stronger transmission interconnections. The interconnections will require rights-of-way across the countryside and in urban areas that will be more difficult to obtain. Transmission voltages above EHV levels must be seriously considered for best use of rights-of-way and for improvement in power system reliability. Now is not too early to think about building transmission lines for operation at higher UHV voltages in the future. (USBR)
W71-05912

INITIAL EXPERIENCES ON THE 765 KV SYSTEM OF THE AMERICAN ELECTRIC POWER COMPANY (USA),
American Electric Power Service Corp., New York.
H. C. Barnes, and V. Caleca.
Int Conf Large High Tension Elec Syst, Paris, France, Aug-Sept 1970, CIGRE 31-06. 13 p, 16 fig.

Descriptors: *Extra high voltage, Transmission lines, *Test results, *Transmission (Electrical), *Experimental data, Switching surges, Radio interference, Overvoltage, Reliability, Instrumentation, Field tests, Ultra high voltage, Accuracy, Electric power.
Identifiers: Test transmission lines.

159 switching operations and other tests were made on the first 765-kv line and stations placed in service in the USA by the American Electric Power Company. A general description of the sytem is given. Extensive data were obtained and compared with design data in the areas of switching surge overvoltage generation under varied conditions, methods for limiting overvoltages, characteristics of equipment, and radio interference and audible noise. One conclusion is that accurate modeling of magnetic circuits, characteristics of nontransposed lines, and loading factors are required if transient network analyzers are to predict performance with reasonable accuracy; otherwise, results are pessimistic. Results of the initial analysis of collected data are presented. (USBR)
W71-05913

A STUDY OF THE DESIGN PARAMETERS OF UHV LINES,
J. Clade.
Int Conf Large High Tension Elec Syst, Paris, France, Aug-Sept 1970, CIGRE 31-05. 18 p, 10 fig, 6 tab, 9 ref, append.

Descriptors: Electric coronas, Overhead ground wire, Flashover, Ice loads, *Transmission lines, Transmission towers, Contamination, Radio interference, Switching, *Ultra high voltage, Wind pressure, Foreign research, *Design, Interconnected systems, Clearances, Electric corona losses, Electric conductors, Bundled conductors, Electrical faults, Ice.
Identifiers: France, Italy, Great Britain.

The prospects of using UHV lines and their potential functions in France, Italy, and the United Kingdom are reviewed. The main parameters of the 765-kv lines and the reasons and methods adopted for their selection are described. These include conductor specification, switching-impulse level for conductor/tower and conductor/ground clearances, radio interference levels, and pollution requirements of the V-string support insulation selected. Results are included of laboratory studies of impulse and power-frequency flashover and radio interference performance of V-strings and of power-arc performance of the fittings. Overhead ground wire specification and installation are studied with respect to fault-current rating and Joule losses, and a scheme for partially insulated construction is described. The mechanical requirements of the tower design with respect to wind and ice loading are given particular attention. Some common rules for loadings are prescribed and comparisons made between towers designed by each of the 3 countries to these rules and to existing national regulations. (USBR)
W71-05914

SCAPER PRODUCTION SPEEDS PIPE TRENCHING AT LOWER COSTS,
William Donnely.
Construct Methods Equip, Vol 51, No 8, p 38-41, Aug 1969.

Descriptors: *Trenches, *Excavation, *Backfill, *Construction equipment, Comparative costs, Comparative productivity, Linings.
Identifiers: *Scraper.

Extra-wide slots for pipes were opened by scrapers thus adding width that provides operating room for direct machine excavating and backfilling and eliminates any hand shoveling. With this method, the scrapers complete the trenching and backfilling

50% faster with an overall saving of some 20% in total labor costs. Before pipes are placed the trench receives a 2-inch layer of leveling sand followed by a plywood screed creating a contoured bed in the sand for the pipe. A detailed description of the equipment used in the trenching is included.
W71-06287

GRAND COULE THIRD POWERPLANT NOISE CONTROL STUDY,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
T. H. Logan, R. H. Auerbach, C. C. Hutton, and G. J. Serpa.
Available from NTIS as PB-195 714, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-49, October 1970. 18 p, 13 fig, 4 tab, 26 ref.
Identifiers: *Noise, *Noise reduction, Sound, Sound waves, Barriers, Turbines, Environmental effects, Environmental tests, Acoustic equipment, Acoustic insulation, Acoustics, Hazards, Measuring instruments, Analysis, Hydroelectric plants, Field tests, Vibrations, *Grand Coulee Powerplant, Wash, Sound dampers, Acoustic energy, Health protection, Operating personnel, Visitor centers.

Grand Coulee Third Powerplant was recognized as a potential source of undesirable noise. Of major concern were noise levels in the residential areas produced by the transformers, exposure of O and M personnel to high noise levels inside the powerplant, and exposure of visitors to high noise levels in the turbine pits and on a crossover bridge above the transformers. Procedures, equipment, noise level measurements made, and method of analysis used to study the problem are presented. Conclusions are: (1) lowering the transformer noise level specification from 89 to 80 dBA, coupled with the barrier effect of the powerplant superstructure and normal attenuation with distance will prevent any appreciable rise of noise level in the residential areas; (2) since the Third Powerplant will be operated remotely, O and M personnel will spend only short periods of time in the noisier parts of the plant, and hearing protectors can be used most effectively; (3) reduced transformer noise levels, coupled with the barrier effect of the bridge structure, will result in acceptable noise levels on the crossover bridge; and (4) noise barriers are necessary in the turbine pits to protect visitors from discomfort and difficulty in conversing.
W71-06329

TRENCHER AND BOX SHIELD MAKE SEWER JOB ALMOST ONE-RIG OPERATION.

Construct Methods Equip, Vol 51, No 4, p 134-135, 138-140 and 143, Apr 1969. 8 fig.

Descriptors: *Excavation, *Construction equipment, *Cost analysis.
Identifiers: *Hydraulic trencher, *Storm sewers, *Guidance system, Oakland, Michigan, Laser beam.

A tractor-powered hydraulic trencher used a three-line bucket arrangement to perform digging for a 43,000-foot storm sewer in Oakland, Michigan. A box shield moved ahead 28 inches at a time and carried a hopper to distribute gravel for the pipe bed. Job difficulties held cost savings to about 10% below conventional backhoeing, but the trencher did protect against cave-ins in addition to providing safety in opening a trench parallel to gas and water lines. The trencher had three basic components: (1) a standard Cat D9 up front; (2) a ladder type bucket line and transverse unloading conveyer; and (3) a hydraulically powered telescoping box that slid along two sled type runners. Dimensions of each part are given along with details of the workings and operation of the trencher and its parts. Loading of spoils to trucks is described. Two guidance systems are mentioned; one which used a survey string line, and the other which employed an Acme laser gun
W71-06334

TOOLS OF THE BUILDER.

Construct Methods Equip Vol 51, No 2, p 164-168, 170-172, 174-175, 177-178, 180, 183-184, 186, Feb 1969. 15 fig.

Descriptors: *Construction equipment, *Tunneling machines, *Tunneling, *Hydraulic equipment, Tunnel construction, Piping, Control systems, Concrete construction, Electronic equipment.
Identifiers: *Mole, Laser beam.

This article explores advances made since 1963 in equipment used by contractors in non-highway construction. Means for handling, lifting, and moving materials grew steadily in size and power. Conventional-type equipment--cranes, derricks, conveyors, and pumps, became taller, stronger, and more versatile. Earth and rock boring for tunnel construction became easier with the development of machines able to tackle any type of geological formation. Special rigs are described which place large-diameter piping inside long tunnels. Advances in mole tunneling are cited. Hydraulic pumps, driven by electric motors, provide rotation, twist, and up-and-down actions of the boom and bucket, and they also propel the machine. Construction crews use laser beams as constant reference lines. They are visible day and night for long distances and are weak enough to be harmless. Future tunneling may be accomplished by rapid melting of rock with lasers or electron beams. New innovations discussed include: hydraulic-boom cranes, hydraulic fork lifts to handle heavy wall and slab forms, lightweight plastic-foam materials, concrete pumps, electronic computers, and television.
W71-06335

LASER BEAM AND POWDER-ACTUATED TOOL SPEED PIPE LAYING.

Water Sewage Works, Vol 115, No 12, p 574-578, Dec 1968.

Descriptors: *Installation, *Construction equipment, *Application methods, Sewers.
Identifiers: *Laser beam, Laser kit.

A new laser beam-aligner system, which includes a powder-actuated fastening tool as basic hardware, is enabling contractors to complete sewage installations at least 35% faster and with virtually 100% accuracy. Basic kit and hardware can meet more than 95% of requirements for average storm and sanitary sewer contracting job. Laser kit is designed for application with precast manhole with concrete base, concrete base without precast manhole, or simple bottom-of-the-ditch installation without concrete base. It is accurate in uphill or downhill alignments.
W71-06354

TRENCHLESS PIPELAYING DEMONSTRATED.

Water Waste Treat, Vol 12, No 2, p 71, Jul/Aug 1968.

Descriptors: *Tunneling machines.
Identifiers: *Great Britain, *Badger Major.

The Badger Major, a trenchless pipelaying machine, has been designed to revolutionize the laying and ducting of plastic pipes, pvc pipes, and cables in all types of soil and climatic conditions for water supply, sewage, land drainage, etc. The Badger Major works on a trenchless principle, passing through the ground a narrow blade with specially designed expanders at its base to create a smooth tunnel for the pipe. The control of the machine is fully automated by the use of an infrared light beam and hydraulic systems engineering. The system gives a working range of 2000 feet; accuracies of plus or minus 1/2 inch vertically and plus or minus 3 inches laterally are achieved.
W71-06358

BUILDING DRAINAGE PUMP STATIO WITHIN LIMITED BUDGET,
E. W. Fritschi.
Public Works, Vol 100, No 2, p 104-105, 1969.

Descriptors: *Design, *Louisiana, *Pump plants, Construction.

The design of a pump station, located 15 mi south of New Orleans, is described. The prim stage of the pump station was designed for rain of 2.5 in. for one hour and then 1/2 in./hr for a to of 6 in. Emphasis was placed on the design of a s structure which had to serve as a cofferd preventing leakage from the tail bay into the s tion bay, and as a retaining wall resisting verti horizontal and lateral forces. Requirements w met by designing a series of bays that structur act as a continuous arch bridge.
W71-06378

SOLVING A SEWER OVERFLOW PROBLEM
Charles R. North.
Public Works, Vol 97, No 4, p 92, Apr 1966 diag.

Descriptors: *Sewers, *Design, *Planning, *Pur ing plants, *Overflow, Investigations.
Identifiers: *Painesville, Ohio.

The 1910 sewer line in Painesville, Ohio discussed. A pump station and force mains w added to an existing sanitary sewer system, subsequently caused flooding. An investigation undertaken to identify and correct the cause of problem. The following conclusions were includ (1) in future designs, considering the capacity older sewers as two-thirds full; (2) recommend of camera inspection with semi-annnual cleani (3) running of pumps on an alternate basis; telemetering; (5) checking of the upstream side the pump station for excessive infiltration; and, checking the operation of the regulator.
W71-06387

8D. Soil Mechanics

THE INFLUENCE OF STRAINS IN SO MECHANICS,
Cambridge Univ. (England).
K. H. Roscoe.
Geotech, Vol 20, No 2, p 129-170, June 1970. p, 36 fig, 1 tab, 56 ref.

Descriptors: Soil engineering, *Soil mechanics, properties, Soil tests, Stress, *Strain, Shear te Stress-strain curves, Foreign research, *Defor tion, *Soils, Displacements, Bibliograph Behavior, Retaining walls, Foundations, *Mo tests, Loads (Forces), Soil pressure, Stress distri tion, Soil classifications, Test equipment.
Identifiers: Soil-structure interaction, Stress pa *Rankine Lectures, Coulomb-Mohr criterion.

The aims of a research program at Cambri University, Great Britain, on the stress-st behavior of soils are outlined. The principal ob tive of the research is to develop simple meth for making reliable predictions concerning load-deformation characteristics of soils at working loads. The pressing need for studying load-deformation behavior of soils in mixed bo dary value problems at model scale is emphasi New versatile shear test equipment than can pose a wide range of stress and strain paths, nondestructive methods of checking the uniform of the behavior of specimens are described. Typ data presented for one problem illustrate the va tion of the passive pressure on a retaining wall the displacement of the wall into sand. A revi statement of the Mohr-Coulomb failure criterio proposed, taking into consideration the evide that rupture surfaces coincide with zero-exten lines. Relationships of stress with velocity cha teristics are discussed, and how they might be u to determine the load-deflection behavior of

ructure on or in soil is indicated. The immediate actical importance of centrifugal model tests is own. (USBR)
71-05907

NGINEERING BEHAVIOR AND STRUCTURE F COMPACTED CLAY,
niversity of Strathclyde, Glasgow (Scotland); and lford Univ. (England).
Barden, and G. R. Sides.
oc Amer Soc Civ Eng, J Soil Mech Found Div, l 96, No SM4, p 1171-1200, July 1970. 30 p, 18 , 1 tab, 67 ref, 2 append.

scriptors: Behavior, Clays, *Compacted soils, oil structure, Soil tests, Soil engineering, *Soil chanics, Soil properties, Moisture content, onsolidation, Pore air pressure, Pore water pres-e, *Pore pressure, Soil compaction, Collapse, elling, Permeability, Negative pore pressure, reign research, Bibliographies, Microstructure. ntifiers: Soil pore structure, Great Britain.

gineering properties of a compacted, partly satu-ed clay have been determined in a comprehen-e series of laboratory investigations. Results e been correlated with previously published ults of a large number of workers on other clays. lding water content has had a dominant effect a wide range of engineering properties of a com-ted clay soil. Microscopic examination of the structure shows that the major differences exist he macrostructure, and these have accounted the main variations in engineering behavior. practical implications of the findings relate nly to the pore pressure and consolidation avior of compacted clay fill. Natural, partly rated clays will exhibit many similarities, de-ding on whether the air voids are continuous or luded. When clays are dry of the Proctor op-um moisture content, with continuous air voids, consolidation problem exists in the classical e; major problems are associated with swelling collapse on wetting. Wet of the Proctor op-um, with occluded air voids, consolidation is a or problem and the Terzaghi theory is generally elevant as any of the more complex theories. BR)
1-05908

VIEW OF SHEARING STRENGTH OF CKFILL,
. Leps.
Amer Soc Civ Eng, J Soil Mech Found Div, 96, No SM4, p 1159-1170, July 1970. 12 p, 1 5 tab, 9 ref, append.

criptors: *Rock fills, Rockfill dams, Rock pro-ies, Internal friction, Soil mechanics, *Shear ngth, Shear tests, *Reviews, High pressure, ability, Normal stress, Slope stability, Particle e, Low pressure, Confining pressure, Rock e stability, Rock tests, Triaxial tests. tifiers: Friction factors.

steady development of large-scale triaxial r testing equipment in the United States and ico has permitted the laboratory testing of fill specimens having up to 8-in.-size particles. imens of smaller-size particles can be tested r confining pressures up to 2000 psi. A review consolidation of published test data and re- show that competent authorities have found fill friction angles varying widely with various meters such as confining pressure, relative ity, gradation, particle strength, degree of satu-n, and particle shape. The most basic parame-ppears to be confining pressure, with the con-t indication being that for average dumped fill, the friction angle varies from about 55 deg ry low normal pressure to about 35 deg at very normal pressure. (USBR)
-05910

SETTLEMENT PROBLEM ORIENTED COMPUTER LANGUAGE,
Illinois Univ., Chicago; and Massachusetts Inst. of Tech., Cambridge.
R. L. Schiffman, R. V. Whitman, and J. C. Jordan.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 649-669, Mar 1970. 21 p, 10 fig, 7 tab, 19 ref, 2 append.

Descriptors: Bibliographies, *Computer programs, *Foundations, *Soil mechanics, Rockfill dams, Foundation investigations, Computer systems programs, *Computer applications, *Settlement (Structural), Test fills.
Identifiers: *SEPOL (Computer system), ICES (Computer system).

Settlement Problem Oriented Language (SEPOL) is designed to aid in the calculation of predicted magnitudes and progress of settlement for shallow foundations. The version of SEPOL described in this paper operates within the framework of the ICES system. The operation of ICES SEPOL-1 is described using 2 examples. The first example calculates the stresses beneath a rockfill dam; the second example presents the calculations of magnitude and progress of settlement beneath a test fill. (USBR)
W71-05915

EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF A PASSIVE EARTH PRESSURE PROBLEM,
Cambridge Univ. (England).
R. G. James, and P. L. Bransby.
Geotech, Vol 20, No 1, p 17-37, Mar 1970. 23 p, 20 fig, 1 tab, 38 ref.

Descriptors: Bibliographies, *Soil mechanics, *Earth pressure, Sands, *Passive pressure, Laboratory tests, *Retaining walls, Rupturing, *Soil pressure, Failure (Mechanics), Pressure, Failure surfaces.
Identifiers: *Plane strain.

The paper presents data from the experimental investigation of the passive failure of an initially vertical, rough, plane wall which is rotated about its toe into a mass of dry sand with an unloaded horizontal surface. The sand is constrained to deform in plane strain. Measurements are made of the distribution of the normal and shear stresses on the wall while strain fields are determined from observations by an X-ray technique of the positions of lead shot buried in the sand mass. The form of the rupture surface mechanism in dense sand is determined. (USBR)
W71-05919

PREDICTION OF MOISTURE MOVEMENT IN EXPANSIVE CLAYS,
Texas Univ., Austin. Center for Highway Research.
For primary bibliographic entry see Field 02G.
W71-06272

8E. Rock Mechanics and Geology

FORMATION EVALUATION BY INSPECTION WITH THE BOREHOLE TELEVIEWER,
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 07B.
W71-05916

THE NUMERICAL DETERMINATION OF STRESSES AND DEFORMATIONS IN ROCK TAKING INTO ACCOUNT DISCONTINUITIES,
Karlsruhe Univ. (West Germany).
H. Malina.
Rock Mech, Vol 2, No 1, p 1-16, May 1970. 16 p, 9 fig, 23 ref.

Descriptors: Rocks, Fissures (Geology), Stress, Strain, Theoretical analysis, Bearing capacities, Analysis, Bibliographies, *Rock mechanics, Joints (Geology), *Rock foundations, Rock properties, *Footings, *Finite element method, *Foundations.
Identifiers: Computer applications, Rock footings, Geomechanics.

The finite element method allows the numerical determination of stresses and strains in elastic structures of arbitrary shape. The author uses the method to handle geomechanical problems after additional steps have been introduced to meet the special requirements of geomechanics. In evaluating stresses and strains, calculating the mechanical influence of given joint systems and additional joints caused by material fractures is possible. The paper contains an introduction to the principles of the finite element method and a description of the additional steps required to include inelastic properties. The method of calculation has been programmed for digital computers and has been tested successfully. An example of a continuous footing on rock with one system of joints demonstrates the applicability of the method. (USBR)
W71-05917

MODIFIED TRENCHER SLICES THROUGH FLINT-HARD ROCK,
Lorraine Smith.
Construct Methods Equip, Vol 52, No 6, p 74-78, Jun 1970. 10 fig.

Descriptors: *Rock excavation, *Drilling equipment, *Drainage systems.
Identifiers: *Storm sewers, *Trencher.

A Texas contractor bought a strong stock model trencher and modified it to meet the need for a storm sewer to be cut through hard rock in downtown areas where blasting is forbidden. Major changes in the rig include the addition of three unique features: an adjustable three-part wheel, an hydraulic mast, and an adjustable crumbing shoe. Minor modifications include: converting the mechanical drive train from a 21- to a 42-tooth sprocket to increase torque on the cutting wheel, reinforcing the idler axle, and replacing an 8-foot Jetco arc-type conveyor with the Parsons original. The trencher not only cut through flinty rock, but it kept well ahead of rigs forming the cast-in-place drain.
W71-06411

8F. Concrete

STABILIZED BASE FOR RESIDENTIAL STREETS,
W. J. Gallup.
Civil Eng, Vol 39, No 5, p 40-42, May 1969.

Descriptors: *Design, *Construction materials, *Illinois, Cements, Construction equipment.

A public works project devised to improve streets and drainage in Stickney Township, Ill. is described. For street improvements, soil cement was used to stabilize bases when streets were covered with 2 in. of asphalt. Depending on the conditions in a particular area, a contractor would either set up a central-mix plant to process base material or would mix it in place. Excavation for the central-mix operation was done with a track-type end loader, a motor grader and dump trucks. Equipment as well as self-loading scrapers were used for in-place processing.
W71-06292

REHABILITATION OF A CONCERT SEWER UNDER INFILTRATION PRESSURE,
Harold H. Haugh.
Public Works, Vol 100, No 7, p 89-90, Jul 1969.

Descriptors: *Concrete additives, Concrete technology, Sewers.
Identifiers: Coating method.

The successful conversion of a storm sewer into a sanitary sewer in Albert Lea, Minnesota is discussed. It was necessary to apply Cital-Aquacoat as a coating on the wet surface of the concrete sewer, which was under hydrostatic head conditions, in order to give the required protection.
W71-06294

WINNER 3.6% UNDER ON CALIFORNIA STORM DRAIN.

Eng News-Record, Vol 184, No 3, p 46, Jan 15, 1970. 1 tab.

Descriptors: *Construction materials, *Costs, *Concrete pipes, *Concrete construction, *Bids, California.
Identifiers: *Bedding material, Solid shoring, Storm drainage system.

Costs and quantities of materials proposed for use in the construction of a storm drainage system in Torrance and Los Angeles, Calif. are tabled for the two lowest contract bidders. The hired contractor will use reinforced concrete box construction and reinforced concrete pipe. Excavated sandy silt material will be used for bedding. Solid shoring is necessary for most of the project.
W71-06340

SEWER IMPROVEMENTS CALL FOR TRUNK.

Water Sewage Works, Vol 116, No 10, p 406-407, Oct 1969. 3 fig.

Descriptors: *Construction materials, *Pipelines, *Installation, Infiltration.
Identifiers: *Asbestos-cement piping, *Palo Alto, California.

Asbestos-cement piping was installed in Palo Alto when urban growth caused an increase in sewer problems and demands. Because a large portion of the pipe had to be laid below the water table level, city engineers considered endurance, infiltration factors, and a construction course in deciding upon materials for the sewers. Steps in the installation procedure were outlined. Prior to final acceptance of this trunk line, tests were performed, and no infiltration was found. Dimensions are listed for amounts used of each type of asbestos-cement piping in the three-mile project.
W71-06353

UNDERWATER LINE SPANS 32 FEET BETWEEN SUPPORTS.

Am City, Vol 84, No 8, p 58, Aug 1969.

Descriptors: *Concrete pipes, *Installation, *Construction equipment.
Identifiers: *Underwater pipeline.

An underwater pipeline of prestressed concrete units was installed in St. John's River as an outfall sewer from a waste treatment plant to serve a new industrial area of Jacksonville, Florida. Double sections of cylinder pipe were laid on concrete piles topped with precast concrete caps to cradle the pipe. Scuba divers guided and joined pipe sections. Extensions and other installation techniques are given.
W71-06362

PAVING CURES DUST AND DRAINAGE ILLS,
Jack Lough.
Am City, Vol 84, No 7, p 97-98, Jul 1969.

Descriptors: Concrete construction, Drainage programs, Storm runoff.
Identifiers: Street drainage.

A far-reaching street-paving program was implemented in Albion, Nebraska after heavy rains caused driveway culverts to overflow, ditchwater to stagnate, and runoff to spill into streets and parkways because ditches were clogged. Concrete curbs, gutters, and pavements were installed to ameliorate this situation and also to provide dust control. The entire project cost $473,619.48 (about $5700 per block).
W71-06383

CALCAREOUS PIPE FOR SEWERS,
R. D. Pomeroy.
J Water Pollution Control Fed, Vol 41, No 8, p 1491-1493, Aug 1969.

Descriptors: *Aggregates, *Concrete pipes, *Sewers, *Testing, *Pipes, *Corrosion, Drainage water.
Identifiers: *Pipe materials.

Although the use of calcareous aggregate in the manufacture of concrete pipe for sewers has been advocated for those situations where there is a hazard of mild sulfide conditions, there is a lack of data comparing this material with others. Tests on five 8-inch diameter pipes handling septic waste water were run for a period of seven years. Results show that the rate of corrosion was inversely proportional to the alkalinity of the pipe materials. The pipe with composition of type II cement plus limestone aggregate had a rate of corrosion approximately one-third as great as the average of the others made without limestone aggregate.
W71-06407

LOW COST STORM DRAINAGE WITH PAVED CHANNELS,
Clifford Wendell, and Robert Emmons.
Public Works, Vol 101, No 4, p 110-111, Apr 1970.

Descriptors: *Drainage systems, Design data, Concrete construction, Storm drains.
Identifiers: *Drainage channels.

Rockford, Illinois realized almost a 45% reduction in costs on its drainage system construction by installing concrete paved drainage channels instead of conventional storm sewer systems. Rainfall-runoff data was utilized in designing the channels for the 50-year frequency storm. This longer frequency design provides more adequate protection from flooding, and the channels still retain their self-cleaning capabilities. Dimensions and design diagrams of the paved drainage channels are given.
W71-06413

8G. Materials

IMPROVEMENT OF THE CORROSION RESISTANCE OF ALUMINUM BRASS FOR USE IN SEA WATER CONVERSION PLANTS,
IIT Research Inst., Chicago, Ill.
M. A. H. Howes.
For sale by the SOD, GPO, Wash, DC, 20402, Price $0.50. Office of Saline Water Research and Development Progress Report No 628, December 1970. 42 p, 3 tab, 28 fig, 5 ref. OSW Contract 14-01-0001-1770.

Descriptors: *Desalination, *Copper alloys, *Corrosion, *Protective coatings, *Aluminum alloys, Oxidation.
Identifiers: Aluminum-brass, Boehmite, *Aluminum oxide.

The objective of this program was to develop a selective oxidation process which would yield a coherent corrosion-resistant surface layer on aluminum brass. The process was to be suitable for application on industrial equipment. Sixteen different atmosphere compositions were used at temperatures from 800 to 1400F. It was found that the corrosion resistance of aluminum brass could be significantly improved by heating in partially oxidizing atmospheres at 1200 to 1400F. These results are based on autoclave testing, and final conclusions cannot be drawn regarding the effectiveness of the enhanced surface layer until further loop t completed. However, at this stage selectiv tion seems a very promising way of reducin sion rate and improving the life of aluminu in seawater converters. (Filban-Office o Water)
W71-06234

Application of Iron-Aluminum Base A Saline Water Conversion,
Solar, San Diego, Calif.
E. R. Duffy, and J. F. Nachman.
For sale by the SOD, GPO, Wash, DC, Price $0.60. Office of Saline Water Resea Development Progress Report No 626, De 1970. 53 p, 9 tab, 29 fig, 10 ref. OSW Cont 01-0001-1796

Descriptors: *Desalination, *Corrosion, * loys, Iron, Aluminum alloys.
Identifiers: *Iron-aluminum, Alfenol, Therm

The objective of this program is the develop iron-aluminum base alloys which retain re to sea water corrosion with minimum al content and, therefore, maximum ductil scope of testing includes systematic evalu sea water corrosion resistance of three i minum base alloy systems: Alfenol (Fe .. Al menol (Fe .. Al .. Mo), Modified Thermen Al .. Mo .. Zr). The program is divided in stages (1) Fabrication of Test Samples, (2) ing Tests, and (3) Advanced Testing. The loys with the highest aluminum content, al the Thermenol alloy containing ten perc minum, were selected for advanced testing. baseline nor iron-aluminum alloys were sev tacked in the autoclave. The most severe at curred with a Modified Thermenol alloy percent aluminum in sea water steam at 28 alloy was found to be the most corrosion iron-aluminum alloy in moving sea wat molybdenum-bearing iron-aluminum alloys and 16 percent aluminum were equal to or to cupro-nickel in velocity tests at room t ture. However, only the Modified Thermen with 16 percent aluminum approached th sion resistance of cupro-nickel at 190F. (Fi fice of Saline Water)
W71-06235

PLASTICS IN WATER AND SEWAGE TROL,
G. M. Cave.
Surveyor, Vol 84, No 4041, p 44, Nov 21, fig.

Descriptors: *Plastics, *Flow control, * systems, *Construction materials, *Equipm

Rigid plastics, able to provide structural a protective functions, are suggested for use control equipment such as valves, penstock gates, etc. Improvements made in plastics years are noted, and requirements needed troducing the materials to industry are list listed are advantages of well-designed plas stock compared to a conventional unit in c with copper-alloy sealing and bearing s Benefits of these modern materials cannot ized until they are employed to a greater e civil engineering contractors and by engi the water purification industry.
W71-06286

GLASS FIBER-REINFORCED PLASTICS FOR WATER PIPELINES,
E. Faust.
Kunststoffe-Plastics (KUPLAK), Vol 15, 191-193, 1968.

Descriptors: *Pipelines, *Plastics, Cons equipment, Sewers.
Identifiers: *Fiberglass pipe.

Glass fiber-reinforced plastic pipes for water pipelines and sewer pipe systems are described. The technical and economic advantages of applications of plastics in sewer pipes are detailed. Requirements that must be taken into account in selecting proper plastics for special purposes with regard to the use of a glass reinforced polyester pipe are mentioned. The properties and performance of the pipe made by filament winding and centrifugal casting techniques are listed, and the comparison of the production method by filament winding with that by centrifugal casting is examined.
W71-06291

IBERGLASS WINS PIPELINE,
William Marquardt.
Water Sewage Works, Vol 116, No 6, p 228-229, Jun 1969. 3 fig.

Descriptors: *Bids, *Piping systems (Mechanical), Construction materials, Comparative costs.
Identifiers: *Fiberglass pipe, *San Francisco.

Corrosion resistant fiberglass was chosen over a cement-mortar lined steel pipe in competitive bidding for the replacement of a corroded waste return piping system in the San Francisco area. The fiberglass pipe weighed one-tenth of the weight of the cement-lined steel pipe, and the cost of the fiberglass pipe was $5 per foot less. Hydrogen sulfide caused leakage of the original pipe by penetrating the cement lining and steel wall at the welded seams. Three types of fiberglass reinforced plastic (FRP) were used in constructing various parts of the waste return piping system. Dimensions and descriptions of the three pipe types are given, and installation methods are also discussed. Alternate materials investigated and rejected were: cement-lined steel, cement-lined cast iron, asbestos cement, plastic protected metal (IPM), reinforced concrete, glass or glass-lined pipe, uncoated steel or cast iron, epoxy-coated steel, and vitrified clay pipe. Reasons for rejecting these materials were given.
W71-06300

WERS UNDER ATTACK,
L. Marsden-Jones, and J. A. Foster.
Surveyor, Vol 85, No 4053 and 4055, Feb 13 and 20, 1970. 3 p.

Descriptors: *Construction materials, *Pipes, Concrete pipes, Asbestos cement.
Identifiers: *Sanitary sewers.

L. Marsden-Jones: With reference to the article, 'Sewers Under Attack' (9 January), he questions whether or not the use of bitumen-coated asbestos pipe implied that concrete could not be used for sanitary sewers. He also wonders if gravel used to surround pipes produces a drainage effect that drains farm land where groundwater is short in supply and, at sewage works, raises groundwater level causing floods. J. A. Foster: In reply to this last question, he notes that only the specific circumstances at Doncaster warranted use of bitumen asbestos-cement pipes and that for most sanitary sewers, concrete is a suitable material. He further explains reasons for Doncaster's use of the unusual material. In answer to the second point, he states that normal practice in waterlogged ground is to apply impervious clay cut-off walls at proper intervals to prevent groundwater movement along pipelines.
W71-06301

ASTIC FITTINGS SPEED LAYING OF SEWER PIPE.
Contract Record, Vol 81, No 10, p 73, Oct 1968.

Descriptors: *Pipes, *Construction equipment, Construction materials, Installation.
Identifiers: *Transite pipe system.

The Roll-Tite system which combines a Transite asbestos-cement pipe with a new type of plastic fitting blow-molded from black polypropylene, is described. The installing operation for this system takes considerably less time than for other systems. Other advantages of this system as well as distributive information are mentioned.
W71-06338

PLASTIC MAY BE PIPELINER'S BOON.

Eng News-Record, Vol 184, No 10, p 28-29 Mar 5, 1970.

Descriptors: *Plastic pipes, *Installation, Cost comparisons, Construction materials.
Identifiers: *Germany, *Fusion welding.

In Germany, plastic pipes with up to 40-inch diameters and pieced in 500 to 1,000 foot sections are common engineering equipment. These polyethylene pipes cost slightly more than other types of pipes; however, installation costs are drastically lower, especially when used in long runs. The butt-fusion welding practice is quite routine in Europe. This process of installation is described.
W71-06339

SEWERS UNDER ATTACK.

Surveyor, Vol 85, No 4048, p 38, Jan 9, 1970. 2 fig.

Descriptors: *Construction, *Construction materials, *Sewers, *Pipes, *Installation, Cements.
Identifiers: *Great Britain.

Doncaster sewers were improved once in 1956, but in 1966 a major reconstruction of the pipes was necessitated due to corrosion by sulfuric acid produced by bacterial action. Adjacent to the old sewer, the new sewer was constructed in the material most resistant and readily available, namely, bitumen-coated asbestos-cement. Procedures followed for construction and installation of the pipes is described.
W71-06349

PUBLIC WORKS EXHIBITION PREVIEW.

Surveyor, Vol 82, No 3988, p 82, 130, 135, Nov 9, 1968. 5 fig.

Descriptors: *Construction materials, *Construction equipment, *Drainage systems, *Underground structures, Sewerage, Plastic pipes, Pipes.

Among the previewed exhibits of the Public Works and Municipal Services Exhibition were Metrex sewage and drainage and rigid PVC rainwater systems, a large range of PVC pressure pipe, examples of asbestos-cement pressure pipes, Polydrain PVC underground drainage systems, and plastic pipes. The PVC pressure pipes had a push type Z joint with a lip rubber seal. This joint, which is easy and quick to assemble, had been made practicable for pressure mains of large diameters up to 18 inches. The asbestos-cement pipe display showed not only new pipes but also old, well-preserved pipe that had lain in the soil for many years. One exhibit demonstrated the economy gained in cost, labor, weight, and maintenance when using plastic pipes and systems.
W71-06350

DRAINAGE AND TREATMENT.
For primary bibliographic entry see Field 05G.
W71-06351

ALUMINUM PIPELINE FOR SEA OUTFALL SEWER.
Water Waste Treat, Vol 12, No 11, p 361, Jan/Feb 1970.

Descriptors: *Aluminum, *Pipelines, *Installation, *Construction equipment, *Construction materials, Outfall.
Identifiers: *Great Britain, *Trestles.

A welded aluminum pipeline has been used to extend a sea outfall sewer at Anglesey. Aluminum was selected because of its weight, corrosive nonliability, strength, and resistance to seawater and domestic sewage. The pipeline was assembled progressively by bolting the flanged ends of the 100-foot pieces underwater. The aluminum trestles, to support the pipeline, and the method of installation are described.
W71-06355

STEEL PIPE SELECTED FOR STORM SEWER SYSTEM.

Am City, Vol 85, No 3, p 22, Mar 1970.

Descriptors: *Pipes, Construction costs.
Identifiers: Steel pipes, Storm sewers, Sewer system.

Steel piping instead of the more-commonly used reinforced concrete was employed to construct a storm sewer system in Lakewood, New York. Advantages of this material include its strength, lighter weight, and lower cost. Savings in material cost alone were about 15%, and lower labor costs were incurred because steel is simpler to handle than other materials. Dimensions of the storm sewer system are given.
W71-06360

STEEL STORM SEWER SAVES MONEY FOR PHOENIX,
Sam A. Phillips.
Water Wastes Eng, Vol 6, No 4, p 56-57, Apr 1969.

Descriptors: *Storm drains, *Installation costs, Construction materials, Steel.
Identifiers: *Storm sewers.

In order to fulfill the need for additional storm sewers at the lowest possible cost, the City of Phoenix asked for bids on types of materials which could be used in the construction of an efficient and durable storm drainage system. The city lately installed two such pipelines of asphalt-lined and corrugated, galvanized steel for a cost 20 to 25% below the city engineers' estimate given before other bids were requested. Completed in 1967, these new systems appear completely satisfactory, and their installation was accomplished with greater facility and speed than is usual when materials other than galvanized steel are used.
W71-06406

INSULATED CO-AXIAL PIPELINES,
J. S. W. Riach.
Pipes Pipelines Intern, Vol 13, No 11, p 27-28, 30, Nov 1968.

Descriptors: *Pipes, *Installation, *Piping systems (Mechanical), Drainage.

The installation procedure of a conduit system of inner and outer pipes that is prefabricated off-site in 40 ft lengths together with all elbows, expansion loops, tees, and other special sections is described. It is then delivered to the site for assembly. The annular air space between service pipe insulation and the interior of conduit provides drainage passage for any water which may inadvertently enter the system.
W71-06408

GALVANIZED BETH-CU-LOY STEEL SHEETS - FOR CULVERT PIPE AND UNDERDRAINS.
Bethcon Galvanized Steel Sheets, Bethlehem Steel, Bethlehem, Pa., Booklet 1956, p13-14. 2 fig.

Descriptors: *Steel, *Fabrication, *Construction materials.

Identifiers: *Beth-Cu-Loy.

Beth-Cu-Loy is Bethlehem's trade name for steel which has a small amount (.2 to .3 percent) of copper added to it for resistance to corrosion. When given a 2-oz coating of zinc, and then corrugated, these steel sheets form ideal materials for fabrication of culvert and drainage structures. Bethlehem manufactures culvert sheets for fabricators who form them into culverts and underdrains. Dimensions available are given along with advantages of the materials used, such as their strength and their light weight.
W71-06419

CORRUGATED STEEL PIPE STORM SEWERS.

National Corrugated Steel Pipe Assoc, Schiller Park, Illinois, Booklet STM 168. 32 p.

Descriptors: *Construction materials, *Steel, *Culverts, *Design, *Steel pipes, *Construction equipment, Installation, Data collections, Design standards.
Identifiers: *Storm sewers.

Corrugated steel is the accustomed material used in urban areas for culverts and storm sewers which form a part of Interstate highway construction. This technical manual provides information needed for the design of storm sewers which differ from culverts in details of hydraulics and fittings. The use of corrugated steel pipe insures that the following essentials will be provided: (1) strength, (2) positive couplings, (3) long service life, (4) unchanging hydraulic properties, (5) versatile fittings, and (6) proved materials. Each of these factors is demonstrated in corrugated steel pipe storm sewers. Product details are discussed, including sizes and details of the pipe and pipe-arch; couplers and fittings; and bituminous protective coatings. Technical data explained include: hydraulics and the determination of size, Manning charts, structural design, the height of cover tables, and service life design. Also described are techniques for installation and specifications for materials, fabrication, workmanship and finish, and inspection.
W71-06420

TANKS.

Owens-Corning Fiberglas Corp, Toledo, Ohio, Publ No 1-PE-3578-F, June 1970. 8 p.

Descriptors: *Storage tanks, *Construction materials, *Construction equipment, *Design, *Plastics, Treatment facilities.
Identifiers: *Fiberglas reinforced plastics.

The combined Fiberglas reinforced plastics have been utilized for years in demanding applications because of their chemical and electrolytic corrosion resistance and structural stability. The process industry uses these plastics for chemical storage tanks, gathering lines, salt water injection, and disposal oil well tubing. A detailed description of the design and manufacturing of Fiberglas Reinforced Plastic (FRP) storage tanks is included. Applications for this type of non-corrosive tank are mentioned with special reference to the use of Fiberglas tanks in providing the most economical solution to severe corrosive problems in holding, treating, and settling tanks.
W71-06421

PLASTICS IN WATER AND SEWAGE CONTROL,
C. A. J. Benfield.
Surveyor, Vol 85, No 4048, p 2, Jan 9, 1970.

Descriptors: *Construction materials, *Design criteria, *Plastics.
Identifiers: *Polyester resins.

In this letter to the editor, the author attempts to clarify the original article's reference to inadequacies of glass fiber reinforced polyester resin (RP) when submersed in water. He notes that considerable research has shown raw materials in the form of improved polyester resins, glass sizes, and fabricating processes to permit application of RP in environments of total immersion in water. Practical experience has demonstrated that by considering certain design criteria, RP laminates can be and are being used in the water and sewage control industry. The author also suggests that 'case histories', written by users of plastics components, be published in the journal in order to promote dissemination of design and performance data within the water purification industry, as was recommended in the original article.
W71-06424

PLASTIC RELINING OF SMALL-DIAMETER PIPES,
Raymond M. Bremver.
J Saint Eng Div, Am Soc Civil Engrs, Vol 96, No SA2, p 297-317, Apr 1970.

Descriptors: *Storm drains, *Sewerage, Pipes.
Identifiers: *Toronto, *Storm sewers, *Combined sewers, Plastic pipes, Capacity.

The combined sewer system of the city of Toronto measures approximately 933 miles. In 1965, a 25 year staged and planned program for installing new storm sewers at a net cost of $154 million was instituted as a result of the hydraulic inadequacies of the then existing system. A chart showing the inventory results concerning the sewer system is given. The surcharge amount on water bills is explained and the common defects in the existing sewers are discussed. A detailed report on the method of relining the existing sewers, which involves the insertion of high density plastic pipes into the sewers and the connecting of all private and catch basin drains into the plastic conduit, is given. The effect of relining on hydraulic capacity is explained.
W71-06426

8H. Rapid Excavation

RADIOCHEMICAL ANALYSES OF WATER FROM SELECTED STREAMS, WELLS, SPRINGS, AND PRECIPITATION COLLECTED PRIOR TO REENTRY DRILLING, PROJECT RULISON,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W71-05842

GEOHYDROLOGY OF THE AREA NEAR WOSCO EXPLORATORY HOLE NUMBER 1, UINTAH COUNTY, UTAH,
Geological Survey, Denver, Colo.
J. E. Weir, Jr.
Geological Survey open-file report USGS-30021, December 1970. 27 p, 7 fig, 8 tab, 10 ref. USAEC Agreement No AT- (49-61)-3002.

Descriptors: *Hydrogeology, *Nuclear explosions, *Underground, *Utah, *Subsurface investigations, Oil shale, Exploration, Drilling, Drill holes, Aquifer characteristics, Water yield, Water wells, Flow rates, Water quality, Fractures (Geology), Chemical analysis, Geology, Radiochemical analysis, Spectroscopy, Water levels, Test procedures, Data collections, Logging (Recording), Oil wells, Groundwater movement.
Identifiers: Exploratory hole.

In order to assess the feasibility of fracturing the oil shale in the central part of Uinta Basin in Uintah County, Utah by underground explosion of a nuclear device, an exploratory hole (WOSCO exploratory hole Ex. 1) was drilled during July 1969. Geohydrologic data obtained from this hole, drilled to a depth of 3,234 feet, and other nearby wells are presented along with an interpretation of the data. Jetting tests and a flow test of three water-bearing zones in the Green River Formation of Eocene age indicated very low transmissivities (6 to 18 gall per day per foot) and hydraulic heads sufficient cause flow at the surface. The three zones ha combined flow of 5 gallons per minute. Water fr these zones is briny, ranging in concentration fr 37,000 to 72,700 milligrams per liter of dissolv solids. If a nuclear explosive is detonated at a de of 2,370 feet, just below the apparent rich kerogen-bearing part of the oil shale penetrat fracturing reportedly would not extend downw into the upper water-bearing zone of the Gr River Formation. Under these conditions, wa very likely will not flow into the rubble chimn made by the nuclear explosion. (Woodard-USGS
W71-06153

09. MANPOWER, GRANTS AND FACILITIES

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OPTIMIZATION TECHNIQUES FOR WAT RESOURCE SYSTEMS,
Washington State Water Research Center, P man.
For primary bibliographic entry see Field 06A.
W71-06062

DIRECTORY OF PERSONNEL, WAT RESOURCES, WESTERN NEW YORK.
State Univ. of New York, Buffalo. Great La Lab.

State University College at Buffalo Great La Laboratory Personnel Directory, Fourth Editi 1970. 81 p.

Descriptors: *Water resources, *Personn *Professional personnel, *Documentation, *N York, Surface waters, Groundwater, Hydrolo Water conservation, Water policy, Water pol tion, Water quality, Water resources developme Water supply, Water treatment, Water utilizati Water law, Planning, Irrigation, Navigation, Flo control, Manpower.
Identifiers: *Personnel directory (Wa resources).

This directory has been prepared by the Gr Lakes Laboratory to promote cooperation a coordination in aquatic resources among peo and agencies in Western New York. The inform tion in this directory has been separated into th divisions - subject index, personnel index and ag cy index. To find the individuals and agencies volved with a given aspect of water resources su as aquatic life or drainage, one should consult t subject index. One can find the addresses of su parties by referring to the agency index. The nu bers following the names of personnel and agenc correspond with the categories in the subject ind The Subject Index includes agricultural runo aquatic ecology, aquatic life, data processi drainage, economics, flood control, hydroelect power, industrial effluents, industrial waste wa treatment, instrumentation, irrigation, marine co struction, navigation, physical limnology, polluta analysis, recreation, sensing, sewage, shippi shore erosion prevention, shorelines, systems an ysis, thermal pollution, training, treatment pla construction, waste disposal, water chemistr water quality control, water resources investig tions, water resources planning, water supp water law, and weather. (Woodard-USGS)
W71-06150

10. SCIENTIFIC AND TECHNICAL INFORMATION

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For primary bibliographic entry see Field 07C.

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Franklin Inst. Research Labs., Philadelphia, Pa.
For primary bibliographic entry see Field 04C.
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RADIATION TREATMENT OF SEWAGE,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
For primary bibliographic entry see Field 05D.
W71-06271

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ABSTRACT SOURCES

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Water Quality Office of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
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